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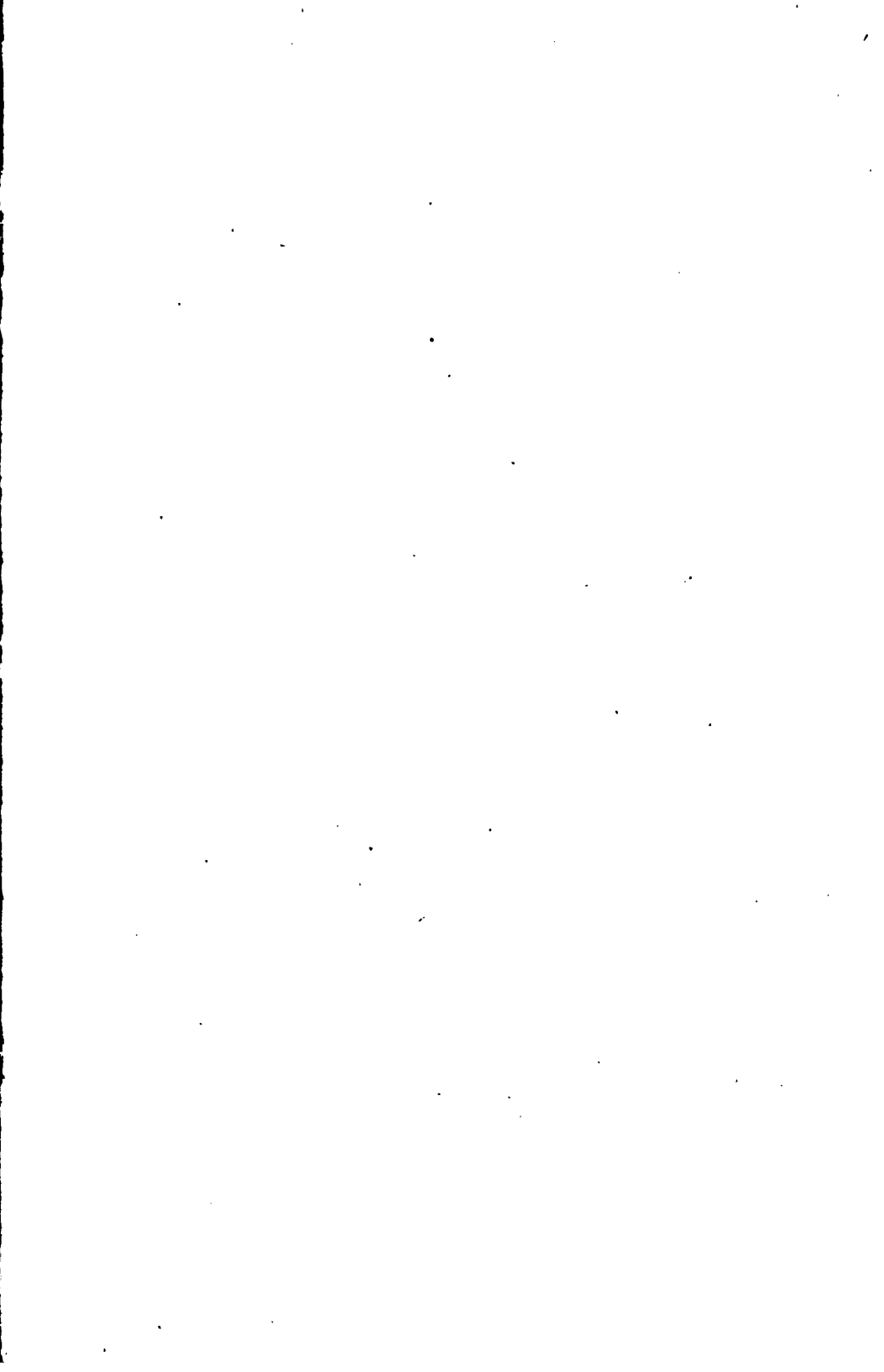
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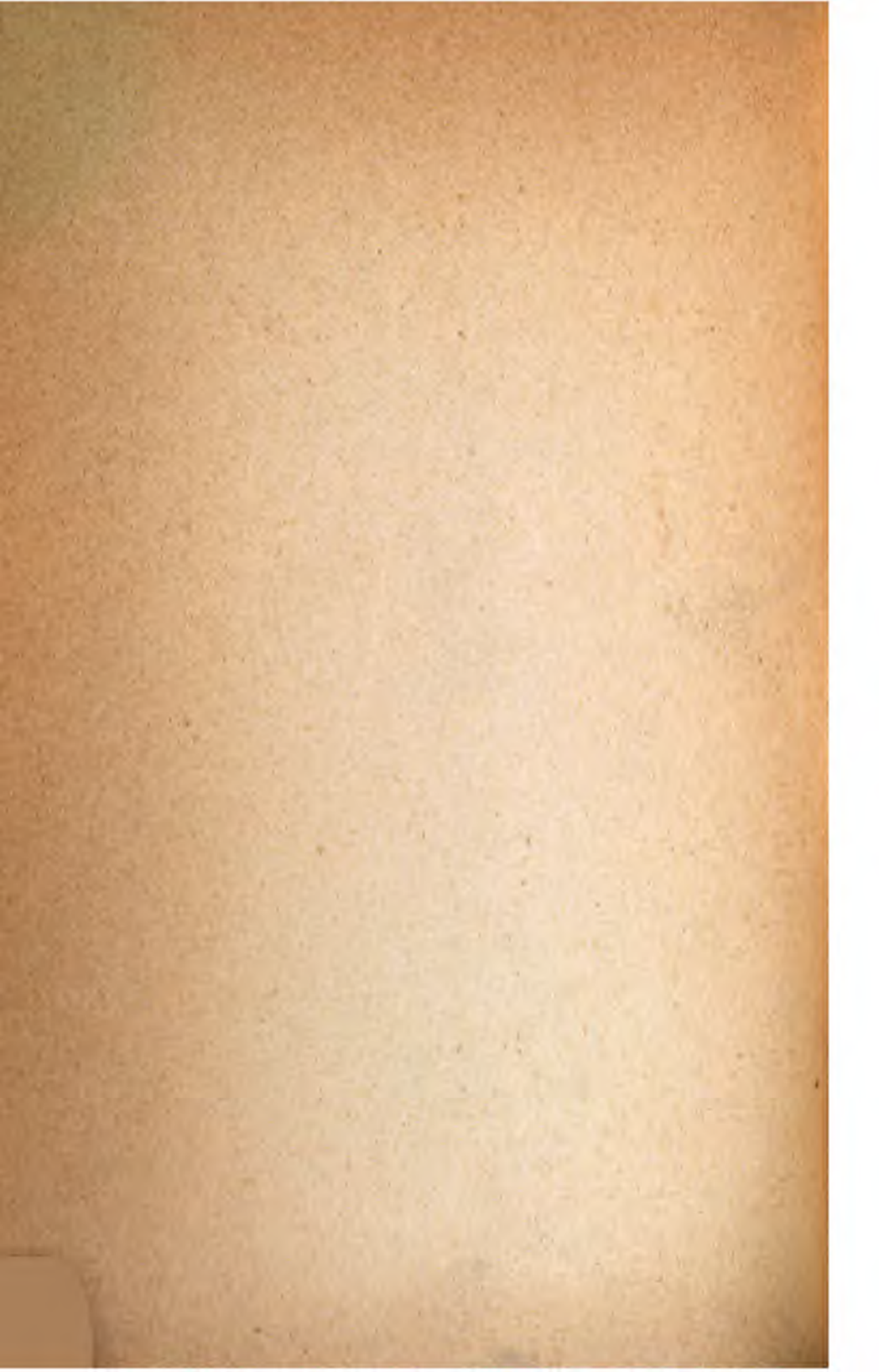
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PRINCIPIA
THERAPEUTICA
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PRINCIPIA THERAPEUTICA



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*Si Deus Avertit Virisq; Intuberit Herbis
Quid Regis Dictamnus Quid panacea Kubat.*

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To
PROFESSOR GEORGE CAREY FOSTER, F.R.S.
IN GRATEFUL REMEMBRANCE OF
HIS CLASS OF PHYSICS

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PROLOGUE

IF it be true, as Plato, the master thinker, has said, that "an unexamined life is not worth living," then it must follow, since the greater includes the less, that an unexamined practice is not worth practising. It is for this reason, and because we are in peril of being engulfed in the ever-rising flood of new remedies, that I have ventured to set down certain considerations, in the hope that they may prove of service to those who have undertaken to navigate the ship of health. There are who make light of general principles, knowledge of detail their sole demand, but this point of view sees one side only of the shield, be it silver or gold as it shall please them ; for whilst doubtless general principles without details make but a foolish business, it is no less true that details without guiding principles yield but a busy foolishness. In default, then, of principles to guide, our ship of health is likely to find herself on a lee shore, in a welter of contending elements. We know that in the main the lines of the ship

are good, likewise the materials, unless misfortune or deliberate misuse have befallen her : we know that she is built for the great waters and the "enlargèd winds," even if she be not so built as to defy shipwreck. We know also that the adventure of the voyage must be made, and made singly, though we put to sea in fleets, and, further, that not generalities, nor averages, will here avail, but individuality alone.

This being so, our first care must be to make ourselves acquainted with the sea-worthiness of the craft which we have to captain. Upon this knowledge everything will depend in the hour of danger, when it is imperative that decision be taken ; upon this knowledge we shall elect either to run before the wind and the pursuing seas, or, with shortened sail, and head to wind, ride out the gale. The knowledge hereunto required is something more than of sail area and soundness of timbers on the one hand, and of force of wind and waves upon the other. The ship of health has its own motive power within, whose fires must be fed from its own stores. How to spend, how to economise ; now with a free hand, now with the most niggardly parsimony ; all will depend upon circumstances, as, for example, whether the nearest port be within reach, or the position on the chart of life such as to forbid the hope of any shelter till the storm be spent. In this problem the composition of forces is complex to a degree, and the

Science of Medicine very far from its solution, but by as much as it is thus distant it makes room for the Art of Medicine. This art, we are told, is long, but something of the journey has been accomplished, and something garnered by the way, and the injunction is laid upon us, not to forget, not to pass by, not to misuse the stores of experience and of knowledge thus laboriously acquired.

PRINCIPIA THERAPEUTICA

CHAPTER I

THERAPEUTICS AND PATHOLOGY—A DIALOGUE

"Eines Mannes Rede
Ist keines Mannes Rede :
Man soll sie billig hören Beede."

SCENE : *The dead-house. Pathologist busily engaged examining a morbid specimen. Enter Physician.*

Path. *Salve, professor, te mortui salutant!*
You were this very moment in my mind, and I was wondering.

Phys. Indeed, and the matter of your wonderment?

Path. This case which you have sent me, and the physician's faith in drugs.

Phys. Nay, the case came, had in fact long been journeying in your direction, and my endeavour was but to stay the traveller's steps. I am come to learn of you the sequel and the reason of the end.

Path. The apothecary tells me there is a long bill on account,—digitalis, strophanthus, sparteine and Heaven knows what more, for I could not out-stay the tale of the remedies employed. Friend, what had you in mind, and what was the real task before you, could you but have seen? See here, this aortic valve, which you rightly diagnosed to be narrowed, it scarcely admits a thin cedar pencil—and the valves, if you can call them such, fused and thickened as they are, and hard as a piece of Roman mortar: they do not look exactly amenable to treatment; did you think to soften them? And this heart muscle, its fibres stretched and degenerate, what hope was there there? Doubtless you proposed to make new fibres to overcome the destruction? What a commentary upon the drug list is here!

Phys. Pray continue, sir, for I perceive the indictment is not yet complete.

Path. Well, with your permission, I had best relieve my mind, not yet recovered from that other case, which you sent me recently—I beg your pardon, which came——

Phys. The case?

Path. The case which died so unaccountably, you are reported to have said, which lived so unaccountably you might have said, for both kidneys were converted into mere membranous sacs. Again the drug list was not spared, and to what end? Of course the patient died.

Phys. Not mine the fault, for, as you say, I did not spare the drugs ; but proceed.

Path. More, would you have more? Look around, friend, for time, not argument is wanting. There they stand, by shelves full, long rows of protests against this therapeutic madness ; protests which shall last, if my art can preserve them. Somewhere, I presume, the physician keeps a conscience, and in time, it is my faith, these shall bring conviction. Let them speak now ; I can afford to be silent.

Phys. You recall a virtue, sir, if we may believe the ancients, and here not wholly out of place, for, as you say, there are sermons enough around us. Whether they preach upon your text however, that I take leave to doubt, and with your permission I will say a few words.

Path. Sir, *we* listen.

Phys. The two instances which you have specifically mentioned, and which doubtless you regard as examples of signal failure, will serve my purpose ; they are indeed striking enough to stand as test cases, and to them I will address my argument.

This case of stenosed aorta which you have so accurately described was taken from the body of a woman. Can you favour me with her age ?

Path. Seventy-six.¹

¹ Cf. "Valvular Disease of the Heart," Peacock, 1865, p. 22. The case here cited is one of Corvisart's.

Phys. Precisely, and her history tells, I think, that, though always ailing, her symptoms did not point definitely to failing heart until after her sixty-seventh year. The rigid valves are so thickened that the orifice is reduced to a mere chink. Could you perhaps give a date to this calcification?

Path. That would be difficult; it is certainly not of yesterday.

Phys. The change has clearly been of slow development, and I think you will admit that its first beginnings may date back many years, perhaps to infancy, and that in this extreme form it must have existed for many months, and not improbably for several years.

Path. Agreed.

Phys. And yet symptoms have been so surprisingly absent. But as you are well aware, this is no isolated occurrence, and cases as extreme as this have been entirely latent through a long life, and have proved compatible even with seeming good health. This was so in a case which I have in mind, in which the patient, also a woman, again reached the age of seventy-six.¹

Path. Need we elaborate this portion of the argument?

Phys. Willingly I pass on, but first let me very briefly insist upon the inference, viz., that this specimen declares vitality, not mortality. Here, for instance, is a vital organ irreparably damaged at

¹ "Valvular Disease of the Heart," Peacock, 1865, p. 21.

the fountain-head, so to speak, and yet the patient outlives her three score years and ten.

By what means? You have called attention to the dilated chambers of the heart and to the stretched and degenerate fibres of the muscular walls; you have confirmed these degenerations by the microscope, and you have admitted, I think, that these same changes give clear evidence of long standing, and that some of them, *e.g.*, the dilatations, must reach back in their beginnings to the first changes in the damaged valve: thus you have borne witness to an inadequacy, declared and long prepared. Not by virtue of these, but in their despite, has life been prolonged, and yet the patient attains to the age of seventy-six. By what means?

Surveying the whole case and placing upon the one side the work to be done, the mass of blood to be moved, the obstruction to be overcome; and upon the other the available forces of the heart muscle, we must confess, I grant it, that the latter *appear* wholly unequal to the task. Yet the sum of it all is a long life. Will you think me unreasonable if I claim this heart as an instance of triumph, not of failure?

Let me proceed to the other case which you have cited.¹ This patient, a lad of eighteen, a farm labourer, was admitted with an excessive diuresis

¹ Cf. case of Dr. Strange, Sir Wm. Roberts' "Urinary and Renal Disease," 4th ed., p. 240.

which dated back a number of years. The renal secretion, which measured some twelve pints per diem at the time of his admission, was of low specific gravity, 1007, and it was free from the presence of either albumen or sugar ; the absence of the latter ingredient had been noted on a former occasion. An endeavour to restrict the excessive flow by limiting the in-take was partially successful, so far as the fluid itself was concerned, but it was followed by an uncontrollable diarrhoea, upon which a vomiting and a drowsiness supervened. These symptoms yielded subsequently, but it was clear that the attempt to limit the flow had not been successful, and free potation was now encouraged. The disturbed balance, however, could not be restored ; cerebral symptoms again set in, and in spite of diuretics and purgatives and other remedies, the patient died in a deep coma.

To the revelations of the post-mortem table you have testified, demonstrating as you did that the kidneys were represented by two fibrous sacs, divided by septa into a number of compartments, and moreover that neither in the walls of the sacs nor of the septa could any trace of proper kidney substance be discovered. You showed, further, that the fluid contained in the sacs and in the dilated ureters, whilst resembling the fluid passed during life, contained no urea.

Now in this case, also, I take it that the kidney change, involving as it did the complete destruction

of the true gland tissue, must have been of long duration.

Path. Undoubtedly, and measured by years.

Phys. Granting this, I must admit with you that it is the living, rather than the dying, which was unaccountable, and moreover if you should charge me with the disaster of this case I shall plead guilty, but in extenuation would urge that the cause of the failure lay in the inability to make a correct diagnosis. Need I add that the catastrophe of an ill-directed treatment is no argument against treatment itself, but only against its ill-direction? You will permit me to claim this case also as a triumph of vitality over mortality?

Path. I shall not attempt to dispute it, but we are still a long way from a reasonable basis to therapeutics, and I have yet to learn what you did aim at doing in the case of the heart failure, which you correctly diagnosed, and what you would have essayed in the second case had you but realised to the full the extent of the renal bankruptcy present.

Phys. I will at once proceed in this matter, but first let me ask, What was the state of the other organs in the renal case?

Path. They appeared to be quite healthy.

Phys. I think we may accept the reality of this semblance; and now to the consideration of these two problems of treatment.

When you ask me whether in the first case my drugs were aimed at the thickened calcified valves

of the heart, I must at once disclaim all such intention. Neither were my efforts directed against the elements of degeneration which your microscope discovered within the fibres themselves. My attention took note of this only, that the heart did beat, and the circulation of the blood was maintained, however imperfectly. This rhythmic contraction of the muscle fibre had no sort of relation to those elements of degeneration within its substance,—they were of death, but this was a living act, maintained in spite of all and every adverse circumstance, and to aid and abet this vital residuum, setting aside all thought of the elements of degeneration, mere mortal remains fit only for interment :—this was my one endeavour.¹

If now you shall ask me, But can you aid and abet the processes of life? that question I shall not attempt to meet in detail : medicine must stand or fall according as she proves herself competent, or not, so to do. It is my part only to indicate the aim which she sets herself, viz., to range herself on the side of life by seeking to establish those conditions which are most favourable to life. These conditions, physical, chemical or physico-chemical,

¹ In connection with this, see case of John Steven,—Balfour, "Disease of the Heart," 2nd ed., p. 349. "To those who witnessed the very great utility of digitalis during the life of this patient, and who afterwards saw the extremely fatty state of his heart, nothing could prove more instructive as to the power of the drug, so long as a trace of muscular fibre remains."

must be capable of modification by those agents, physical, chemical or physico-chemical, which constitute our *Materia Medica*, and which we bring to bear upon the body. But if the conditions are capable of modification, then it must be either for good or for evil,—there is no *via media* here. The introduction of a new factor must disturb the balance reached before its introduction, or we have learnt in vain Newton's law of stability: "*Corpus omne perseverare in statu suo. . . .*" If then drugs are to be denied their power to aid, they must confess to harmfulness, the *advocatus diaboli* will compel this conclusion. But, if we refuse to allow this premiss, which would convert into vices the virtues upon which we had been taught to rely, then the conclusion falls with it, and we must grant that, however ill-selected may have been the means which were adopted in this particular case, their intention was not unreasonable, and to suggest a rational basis for therapeutics is all that concerns us for the moment.

As to the second case, you have asked me what I should have done had I but known the real state of things. Again it would have been my endeavour to aid and abet the processes of life, looking aside from those elements of degeneration to which no therapeutic appeal was possible. But in this case, so far as could be discovered, all true renal tissue had disappeared, and though there was a secretion, and an abundant one, the examination of this,

insufficient I must allow, seems to indicate that it was not of the nature of a true renal secretion. This case, remarkable as it is, is paralleled by some of those cases of cystic degeneration which at times lead to a destruction of the renal tissue to the extent of some nineteen twentieths.¹ In many of these we cannot escape the conclusion that even in an extreme degree the degeneration must have existed for years, yet the patients frequently attain to middle age. Now in these cases, even if we could accept the view that life was maintained by the small remainder of gland tissue proper, one twentieth or less, what shall we say as to the case where none could be found at all? That the kidneys are not vital organs? All experience is opposed to this, and the more reasonable conclusion seems to be that life is "eked out in such cases by the vicarious activity" of the organs.² Here must lie the solution of the problem. This potentiality of the various tissues for the performance of work other than that to which they have been specialised, must derive from the all-round capabilities of the ancestral protoplasm. Once possessed, these capabilities are never wholly forgotten, and on occasion they can be recalled. The answer then to your question is that in every case of damage to one organ or tissue we should call upon the vicarious

¹ W. Roberts, "Urinary and Renal Diseases," 4th ed., p. 569.

² Ibid., p. 539.

activities of other tissues and organs to stand by. In the case of the circulation no other organ can take up the functions of the heart, and all our efforts must concentrate themselves upon the maintenance and encouragement of the living residuum of muscle fibre, but in the case of the kidney, other organs, as the skin, alimentary tract, lungs, etc., can all be enlisted in its service, and to guard against disturbance of these, to maintain them at their highest functional health, and even to stimulate them periodically to an increased activity, such is the obvious procedure. Is this aim an unreasonable one?

Path. It sounds plausible enough, but I cannot get away from these facts, these signatures of death: have they so little meaning for you?

Phys. You speak of these as facts, and such indeed they are, but is the mortality which they record a greater fact than the life which was theirs for so many years? It were folly, in truth, to endeavour to make light of their darker significance, which I trust I do not wholly miss, but my anxiety is that you should not lose sight of that other aspect which they wear, when it is remembered that all these fragments of humanity were parts of living frames, and that these impossible hearts and lungs did pulsate and breathe. If against such odds life was upheld, what limit shall we set to the powers of adaptation and co-operation of the body! And, again, so long as these powers endure, so long as

the pulse beats and a breath is drawn, the living elements which maintain these workings must be capable of influence for good or evil. Herein lie the possibilities and the opportunities of the *Materia Medica*; here is room for an optimism almost as large as that which stirred Paracelsus to rebuke the faint-hearted physician who should dare to doubt the healing powers of his remedies. Such doubts to him being tantamount to a distrust of God, whose will alone could set bounds to the potencies which He had implanted in mineral and herb.¹

Path. I am afraid I must finish the preparation of this specimen. Goodbye.

Phys. Goodbye. For my sake also preserve it well, and forget not, I beg, that it lived to the age of—seventy-six.

¹ "Nie rede der Arzt, die Krankheit ist unheilbar—er lügt da Gott an, unsern Schöpfer; er belügt die Natur mit ihrer Ueberfülle von verhüllten Kräften und Veränderlichkeiten; Er schändet die grossen Arcana der Natur und Mysteria der Geschöpfe" (p. 108). And again: "Aber es muss so sein: würde Gott der Arznei nicht Einhalt gebieten, und sie still stehen heissen wie die Sonne in den Tagen der Josua—wer würde da noch sterben!" (p. 109).—"Theophrastus Paracelsus, Leben und Persönlichkeit," von Franz Strunz.

CHAPTER II

CURATIVE AND PREVENTIVE MEDICINE : BALANCE PHYSIOLOGICAL AND PATHOLOGICAL

PART I

"Libra justa salutem servat."

THE study of pathology should have a very distinct bearing upon treatment. Investigation into the progress of disease, taken back to its very beginnings, brings us to health, and therewith to a recognition of the first departure from health, and presumably to the cause of this departure. Knowledge of the cause should teach us the argument by which we may hope to prevail against and anticipate the first false step.

In fact, pathology does so instruct us, and to it we are indebted for therapeutic advances of the highest importance; but, strangely enough, the relationship of disease to its antecedents has in one direction been singularly misapprehended, so much so that an endeavour has been made to draw distinctions, according as that relationship is near

or remote. This misconception has borne ill fruit in the department of practical medicine, since it has led to a separation in idea between that which is termed preventive medicine, and curative medicine so called. To so great an extent has this been the case that it has become a custom, not to say a fashion, to extol the one at the expense of the other, and to speak as though a difference in kind divided these two departments of practice. Curative medicine it is which has suffered contumely, the grounds of its belittling being that it has concerned itself with symptoms rather than with causes, in contradistinction to preventive medicine, which in a truly scientific spirit has striven to search out the causes of disease and there and then to overcome them. By thus striking at the roots of the tree of evil, preventive medicine has aimed at setting aside that imposing array of remedies which make up the *Materia Medica*, the multiplicity of which has resulted from the endeavour to follow and combat disease in all its ramifications, instead of at its first branchings.

Now whatever need there may be, on *practical* grounds, for this division into the two sections, preventive and curative, there is no difference in kind between them, no essential separation, nor is the one more scientific than the other. This will be manifest if we do but consider that in the long chain of cause and effect which stretches from the present back into the past each link in the

chain is at one and the same moment the consequence (symptom) of the links which have preceded, and the antecedent (cause) of the links which follow on. Thus the ague fit follows upon the microbic invasion; the microbe stands in some causal relation to the mosquito; the mosquito to the marsh; now the marsh depends upon certain telluric conditions; these in their persistence have been permitted, through agricultural ignorance or indifference; behind these have lain an unsound system of economics, the folly of the schools, a moral decadence, certain racial characteristics . . . thus and thus backwards, in never-ending sequence, to the birth of matter and the origin of sin.

But if disease owns such a parentage, by what name shall we call the physician who waits for the rigor of the malarial paroxysm when he might have dealt with the microbic invasion? It will be less harsh only than that which we shall bestow upon the man of science who refuses to treat the pyrexia, because he cannot get at the miasm. As usual pride rides for a fall, for whilst the physician, who with humility treats a symptom, finds that therein he has treated a cause, the man of science who contemptuously passes the symptom by in search of the cause, discovers that he is ever confronted by a symptom. One rule, and one only, must govern our treatment of every form of disease—it is, that we should reach back *as far as possible* in the morbid sequence, and there interrupt it.

That there may be need, on practical grounds, for a division of labour, and the allotting unto some the search into prior causes and the means of dealing with them, unto others the study of the proximate causes of disease, and their cure, this we shall readily grant. In this sense no exception can be taken to the names "preventive" and "curative"; they are convenient and explain themselves. But, again, they do not differ in kind; they are equally scientific in the best sense of the word, and equally important. The millennium is not yet in sight, and till it appear there will always be ample scope for the simple healing art as it finds expression in the words of Ambroise Paré: "I dressed his wounds, God healed him."¹

It is with curative medicine, so called, that we are now concerned, but, before proceeding to the discussion of its methods and guiding principles, it is advisable that we should consider briefly certain aspects of the working of the body as a whole. In his *Pharmacologia*, Dr. Paris says: "It may be laid down as a position which is not in much danger of being controverted that where the intention of a medicinal compound is obscure, its operation will be imbecile."² This statement, which he applies to the formula of the prescription, we may certainly extend to treatment in its whole length and breadth.

¹ "Je le pansay; Dieu le guarit."

² 8th ed., p. 254.

But the intention must be obscure if we are unfamiliar with the fundamental principles which govern the combined actions of the several parts of the body. This sounds much like a truism, for to what other end do we study anatomy and physiology than to gain this very familiarity? Certain aspects, however, of this subject have perhaps received less attention than they deserve, and it is to these that I now propose to call attention.

The first of these may be styled the principle of physiological balance : it shows us a thousand and one parts so coördinated and subordinated in their relations, the one to the other, as to yield an active whole, which, notwithstanding the mobility of all the component parts, presents a solidarity, a stability, which we may well characterise as balance ; understanding by that term the power of the organism to resist disturbance and to revert to its state of rest or equilibrium so soon as the disturbing force is removed. The better the health of the organism, the greater its stability or balance, and *vice versa*, and this applies not only to the body as a whole, but to each of its several parts, for we observe that each part has its own internal stability, its *imperium in imperio*, and that it is possible, within certain limits, to disturb the balance of the part without seriously affecting the balance of the whole—in brief, we find here presented the maximum of local self-government which is compatible with a general control and executive.

It results from the constitution thus sketched that the incidence of a disturbing force must tend to manifest itself in one or other of two directions, or predominantly in one or other of these, viz., as a disturbance of the system generally, or as a local disturbance. Theoretically, it is not possible to touch the whole without modifying the part, or to disturb the part without causing a general perturbation, and theoretically, therefore, general disease must always be accompanied by local disease and again *vice versa*; but practically it is possible for the disturbance to be so limited in the one or other sense, that we may treat this and neglect that.

In the case, then, of what is termed local disease, the disturbing cause having spent itself locally, the cure is to be effected by a treatment equally restricted in its application; whilst in the case of that which is described as general disease, the *materies morbi* having distributed itself to every part of the body and there struck, the predominant manifestation has been a general one, the system expressing its resentment as a whole: to meet this state of things, measures equally general in their application are called for.

It is, however, seldom that we meet with either the purely local or the purely general disease; in most cases the former is attended by some general manifestations and the latter by local symptoms of greater or less intensity, and hence in the majority of instances we have need to combine local with

general treatment. Rarely will it be possible to foretell with certainty how the organism will react; at one time local manifestations of the severest type will subside rapidly under a purely local treatment; at another the local remedy will fail signally, though the disease appear strictly limited, and only when we conjoin the systemic remedy will progress be noticeable. Again it will be our experience that at times the general disorder will fail to respond to the general treatment, until we have sought out and remedied some local, perhaps trivial-seeming, disturbance, such as, for instance, an oral sepsis.

Whenever symptoms appear, general or local, it is manifest that physiological balance has been overcome, and that the system has passed from health to disease. In health the body may be likened to the tumbler toy with its centre of gravity pitched low; thus fashioned, it is ready for the rough and tumble of every-day life, and, constantly deflected from its position of rest, it as constantly recovers its balance and rights itself. The lower the centre of gravity, the greater its power of resistance; the higher the centre of gravity, the less its stability. These variations may stand for the various grades of health, as we meet them, but, whatever the grade of stability, we shall understand, so long as the term health is applicable, that the balance is intact, that the reserve powers have not been encroached upon. Balance such as this we define as physiological.

The second fundamental principle now claims our attention ; it may be described as the pathological balance of the tissues, and it reveals to us the power of the organism as a whole to adapt itself to the presence of a distinctly morbid influence, and to strike a new balance, which is not that of health, but which is the next best thing to it. Examples of this state of things are innumerable, and they will be found to range themselves from that condition of the body which just falls short of robust health, downwards to that lowest level of invalidism, which at every step discovers its limitations. In their lightest and in their severest forms these bodily states represent an encroachment, less or greater, upon the reserve powers of the system, the new factor in the equation having exacted its precise equivalent at the expense of the economy. The reserve powers of the body may be described as its potential, and accordingly this pathological balance may be briefly defined as an instance of diminished potential. However defined, we recognise as a fact of much practical bearing, that cases belonging to this category require very cautious handling. Their balance being less stable, a very tentative procedure in all forms of treatment is necessary, for it is difficult, often impossible, to gauge the degree of instability present. Not uncommonly these cases are marked by the presence of some one or other symptom, which arising in the healthy organism would at once be recognised as a morbid departure

and forthwith be actively attacked, but which, existing here as a symptom of long-standing, must be regarded rather as a factor in the pathological balance, and as such to be severely let alone. Thus it will be remembered how, in Dr. Strange's case, quoted above, the diuresis was so excessive, that under ordinary circumstances it would have called for repressive treatment, but the disaster of its attempted cure by the mere restriction of the fluid intake furnished a striking illustration of the danger of interfering with a symptom which by length of time had incorporated itself, so to speak, in the life of the organism. In this case the pathological balance included the excessive secretion, and this being interfered with, the whole gave way.

I cannot better illustrate this point than by referring to a case under the care of one of our most distinguished physicians, the late Sir William Jenner. The patient had been long under his guidance for chronic renal disease, when, in the course of a journey abroad, active symptoms developed, were at once taken in hand, and as actively treated : within a short time the patient succumbed. A lady recounting the case to Sir William spoke her regret that he had not been present, for then, as she expressed it, her friend would not have died. The answer came that this was unreasonable, seeing that the patient had an incurable disorder,—“ Ah yes, doctor,” she replied, “ but then you would not have attempted to cure it.”

We need not stop to consider whether this criticism was fair upon the treatment of this particular case ; very possibly the time had come when the unstable equilibrium could no longer be upheld : this may have been so, none the less the general force of the remark cannot be gainsaid, nor can we withstand the conclusion that there are morbid states we must not attempt to cure, all our efforts being restricted to the maintenance of the standard of health attained, at whatever level below the normal this may happen to be.

It is in cases such as the above that patients are often told, and told rightly, that they should make friends with their complaint, for that it will be their constant companion. Need we add that this must never be said lightly, and that it is our first duty never to take any symptom for granted as incurable ? Only after careful observation and cautious trials may we accept for the *individual* case the above maxim.

Let us look more in detail at this question of balance physiologic and pathologic ; by so doing we shall become aware of the great powers of self-adjustment which belong to some systems of the body, and the marked complementary or supplementary relations which hold for certain others.

The circulatory system furnishes, perhaps, the most striking instance of self-adjustment, in illustration of which three special manifestations may be cited, viz. : I. the phenomenon of anastomosis ;

II. that of the relation between blood-pressure and pulse frequency; III. that of compensatory hypertrophy.

Anastomosis.—The vascular tree presents us with a system of canalisation in excess of the needs of health, the anastomotic branchings constituting a circulatory potential, which under ordinary circumstances may be entirely latent. In health the flow which takes place through these vessels is a negligible quantity, but let there arise a block on one of the main lines of flow, and at once these connecting channels are called into play. In a given capillary area the circulatory disturbance will be greater or less in inverse proportion to the freedom of the anastomotic circulation. Surgery, no less than medicine, bears witness to the almost inexhaustible reserve powers which anastomosis places at the disposal of the body; still, each call, even the least, is an encroachment upon this reserve, and, in direct proportion to the magnitude of the call, the system is thereby placed at a disadvantage.

Why such structural arrangements as end-arteries should exist, and why moreover these should be found in organs of such primary vital importance as the brain and heart, we need not stay to discuss; they have doubtless their full explanation, but they in no wise negative the positive value of anastomosis wherever it exists.

Relationship between Blood-pressure and Pulse Rate.—This example of adjustment involves a

complicated mechanism, which, however, we may pass over, since all that now concerns us is the fact expressed by the following law: "that the rate of the heart-beat is in inverse ratio to the arterial pressure."¹ The significance of this law, as an instance of the nicety of balance thereby secured, will be at once apparent when we note that, other things being equal, the rate of flow through the vessels will be directly as the frequency of the heart-beat, and directly also as the arterial blood-pressure. The working of this law will, therefore, be always in the direction of the maintenance of an even flow, for as the blood-pressure rises in the arteries a quickened passage of blood across the capillaries must follow, and, to restore the balance, a diminished rate of pulsation will be necessary, and *vice versa*. But the maintenance of an even flow will mean, *cæt. par.*, a constant expenditure of force, and this will make for stability.

In connection with this, we may here make mention of another striking instance of the adjustment of the heart to its work, though now it is the mechanism rather which claims our attention—we refer to the relationship which obtains between the circulation through the heart-muscle, and the arterial blood-pressure. Let us suppose a case of heart failure, no matter its cause, in which the left ventricle is unequal to its task, and in consequence the blood-pressure is low in the ill-filled arteries, the

¹ Foster, "Text-book of Physiology," 6th ed., pt. i., p. 323.

capillary stream is sluggish and the great systemic veins are congested. To attack such a problem as this with digitalis, a drug which, by causing contraction of the arterioles, sets up a new impediment to the already overburdened ventricle, this, at first sight, would appear to be the veriest midsummer madness, yet this very thing we do and do again with great success. In explanation let us observe the steps which follow upon the administration of this drug ; first the arterioles contract, and the blood gathering behind the obstruction begins to distend the arteries ; the arterial distension is immediately followed by an increased gathering of blood within the ventricle, the pressure here rises, and the heart-muscle, responding to the stretch of its fibres by a more vigorous contraction, expels a large volume of blood into the aorta. We have then in fact made a further call upon our enfeebled heart, and its impoverished reserve stores are by so much the poorer. But observe now what happens : the increased volume of blood thrown into the aorta causes a corresponding rise in the aortic blood-pressure, and on this there follows a more forcible recoil upon the semilunar valves and in fuller stream the blood enters the coronaries. Accordingly, the first capillaries to feel the effects of the blood-pressure rise are those of the heart-muscle itself. The improved circulation through its fibres raises their vigour, and the heart, repaid now for its recent exertion, is prepared to respond to the stimulus of

an increased intraventricular pressure by another more vigorous contraction. Slowly the whole aspect of the case changes; the arteries become well filled, the pulse more regular, forcible, and measured, the capillary circulation freer and more sustained, the venous system less gorged. This is no question of theory or of interpretation, it is a sequence of events daily witnessed, not to be denied, neither is there any need to dispute the facts, for, as we follow step by step this sequence, the seeming therapeutic paradox, that the proper treatment for a failing heart is to increase its burden, finds its simple explanation.

Of course if the heart be too far gone to respond to the initial stimulus, the primary rise in blood-pressure will then be useless, nay harmful, and the more gradual failure may then become a *débacle*; but in that case we shall have been confronted by a task hopeless from the very beginning.

Compensatory Hypertrophy. — Every hollow muscle answers an obstruction by hypertrophy, provided always that the metabolism be good. This law of hypertrophy, which we owe to Paget, may be extended and made to include all muscular tissue, since we observe throughout the body that an increased call for exertion is responded to by hypertrophy. It matters not, for our purpose, how this is effected, whether by an increase in size and power of the individual fibres, or by a formation of new fibres, or by both processes combined; the

essential for us to note is that all muscular tissue has this potency *in reserve*.

Starting from this basis, two questions present themselves: I. Is there a limit to this overgrowth? II. Is the hypertrophied muscle in the same position of vantage as the non-hypertrophied one? In point of fact, the second question depends upon the first for its answer.

That there is a limit to hypertrophy is abundantly evident from observations in the wards and post-mortem room; were it otherwise, the obstructed and hypertrophied muscle would indeed be in a condition of complete compensation, for having met the demand upon it by calling upon its reserve fund of contractility, this latter being inexhaustible it would be equally ready to meet any fresh demand. This, however, is not so; the hypertrophied muscle has used up some of a limited store of potential, and by so much it is at a disadvantage when compared with normal muscle fibre. We shall admit, it is true, that for practical purposes the limits to hypertrophy are set within a sufficiently wide range of the normal standard, and that the reserve fund, if used with economy, is adequate to meet even a considerable stress of disease, without curtailing the natural term of life: be it carefully noted, the proviso, if used with economy.

In every instance, then, of hypertrophy, compensation is always incomplete, in the sense that the hypertrophied organ is relatively restricted in its

functional capacity or range, and its balance, therefore, correspondingly unstable. None the less does the phenomenon of compensatory hypertrophy furnish us with a very striking example of the powers of adjustment of the tissues,—powers which make for balance against the disturbing forces of disease.

Nowhere in the body is this phenomenon better exemplified than in the heart, and the conditions under which life is made possible by its means are truly astonishing ; still, for all this, the best compensated heart is at a lower functional level than the healthy one.

It would lead us away from the direct line of our argument were we to enter upon the consideration of the physical or physico-chemical basis, which must underlie this lower functional level ; whether, for instance, it depend upon the presence of degenerative elements in the overgrown fibres, or upon an immature or imperfect development of the new fibres, or upon a state of "fatigue" or "exhaustion" as Cohnheim describes it. For the present it concerns us only to recognise as a fact the limitations of this remarkable mechanism of self-adjustment.¹

¹ See Cohnheim, "Lectures on General Pathology," vol. i. pp. 72, 73 *et seq.* ; see also Balfour, "Disease of the Heart," 3rd ed., 1898, pp. 77-88 ; also Clifford Allbutt's observation as quoted in Fagge, "Principles of Med.," 1st ed., 1886, vol. ii. p. 22.

CHAPTER III

BALANCE PHYSIOLOGICAL AND PATHOLOGICAL

PART II

"Concordiâ res parvæ crescunt."

IN the mechanics of the circulation we have observed powers of self-adjustment constituting a balance of great stability, the need for which will doubtless have been its *raison d'être*, since, unlike certain other systems now to be considered, the circulatory system stands alone, no other organ or organs being able to assist actively, or supplement, its deficiencies.

In marked contrast stand those other systems whose functions, secretory, excretory, form part of the complex chemistry of the tissues. To their correlation we would now draw attention, and in the affinities which the renal system bears to other eliminating organs, we are furnished with the specific instance we need.

In Dr. Strange's case already quoted,¹ both

¹ See p. 5.

kidneys appeared to have been entirely destroyed, no trace of renal tissue being discernible in the two membranous sacs which took their place : this patient attained to the age of eighteen. The case, as already stated, is by no means isolated, being paralleled by some examples of extreme cystic degeneration, in which the evidence is also clear that the kidney destruction in its extreme degree must have long existed. Three possible interpretations arise at once, viz. :

- I. That the spoiled organs are still capable of an adequate renal function ;
- II. That the renal function is not vital to the economy ;
- III. That other tissues and organs can take up and so replace the lost renal powers.

The first hypothesis may be dismissed forthwith, it is a *reductio ad absurdum* of the relation between structure and function. The second is negatived by all our observations of disease, which establish beyond controversy the vital importance of the functions which under ordinary circumstances are performed by the kidney. There remains the third hypothesis, that, viz., of the vicarious powers of other organs.

To inquire into this : if we compare some of the more important excretions of the body, *e.g.*, the renal, the dermic, the respiratory, and the intestinal, we note that in the first place they all throw out water from the system, each secretion containing

this element in greater or less amount. This being so, we find, as we should expect, that the output of water by this or that channel varies inversely as the output of this same element by the one or other of the remaining channels. This complementary relationship is especially noticeable in respect of the renal and dermic systems.

But the solvent powers of water are such that in its percolation through the tissues it takes up a number of bodies; these in the case of the *Urine* may be enumerated as follows :—

1. A nitrogenised group including urea, 45 per cent. ; creatinine, 1·25 per cent. ; uric acid, 0·75 per cent. ; ammonia, 1·06 per cent.
2. A group consisting of pigment and other organic substances, 13·79 per cent.
3. A group of inorganic salts in which we find, sulphuric and phosphoric acids, 7·13 per cent. ; calcium and magnesium, 0·63 per cent. ; potassium, 3·45 per cent. ; sodium, 15·29 per cent. ; chlorine, 10·35 per cent.¹

In this table, chief note should be taken of the quality of the ingredients, inasmuch as the quantitative figures are liable to great variations, as, for instance, when a nearly pure meat diet is exchanged for a nearly pure bread diet.

The Sweat.—In the case of this secretion we find :

¹ "Text-book of Physiology," ed. by E. A. Schäfer, vol. i., 1898, p. 572. The table is taken from Parkes ; the numbers represent the percentage proportions of the total solids.

1. A nitrogenised group represented by urea.
2. A group consisting of extractives.
3. A group of inorganic salts including sulphuric and phosphoric acids, calcium, potassium, sodium, chlorine.¹

In this table we shall recognise the close resemblance which exists qualitatively, between the sweat and the urine. In particular we shall note the presence of urea now conclusively established as present in the sweat of healthy persons,² since it proves that the skin is even under normal conditions a channel for the escape of nitrogen.³

Figures are not added here, because they vary so enormously; thus the total solids of the sweat range from 4.42–22.6 per mille, and the figures of urea, from 0.042–1.55 per mille. The precise meaning of extractives is not clear; they probably include bodies of the urea and uric acid type, and one observer, Capranica, actually mentions creatinine as present. Upon these very small numbers the difficulties of analysis must be obvious.

The Breath.—Passing to the lungs as an organ

¹ Cf. tables according to Favre, Schottin, Funke, *op. cit.*, p. 671. Epithelium and fat are enumerated among the constituents by these observers, but being of the nature of mechanical admixtures they are not included in the above list.

² Schäfer, *op. cit.*, Hammarsten, "Lehrbuch d. physiolog. Chemie," 1891, p. 274.

³ The presence of traces of ammonia in the perspiration is here neglected, though this same ammonia derives probably from urea by decomposition.

of excretion, we note first the presence of water, of which a considerable separation takes place ; inasmuch, however, as the water leaves in the form of vapour, it cannot act the part of a carrier except for such salts as are volatile at the temperature of the body. Accordingly the whole group of bodies present in solution in the water of the urine and the sweat is now conspicuous by its absence ; a minute quantity of ammonia is said to have been found.¹ Carbonic acid, on the other hand, is exhaled in great volume, some 800–1,200 grammes in the twenty-four hours according to Bunge. We have made no mention of the presence in small quantities of carbonic acid in the urine and sweat, yet such is the fact.²

What would happen if a copious liquid secretion were expectorated from the lungs, and what in fact does happen under such circumstances, as, *e.g.*, in bronchorrhœa, that is another question to which we shall return when we come to consider excretion in disease.

The Dejecta.—The excretion of the alimentary tract is very complex : it consists first of food residua, organic and inorganic, the latter including certain salts, *e.g.*, the phosphates of the alkaline earths and of iron, etc. Next it is composed of certain constituents derived from the mucous membrane of the alimentary tract, and the appendages of

¹ Landois, "Lehrbuch der Physiologie," 1889, p. 241.

² Hammarsten, *op. cit.*, pp. 274, 321.

this tract; in this group we find mucin, indol, skatol, certain volatile fatty acids, ammonia, sulphuretted hydrogen, marsh gas, and other bodies (many of these are the result of bacterial decomposition), and further, bile derivatives, stercobilin, cholesterin, traces of bile acids, etc.¹

Regarded from the point of view of its first constituents, the food residua, the excretion is no secretion at all—these same have never entered the system.

Considered in its next aspect, as composed “of the detritus of the intestinal surface” and of certain unabsorbed remainders (more or less changed) of the various secretions of the alimentary tract, the secretion is a very poor one.

It is, however, to this second part that we must look for the evidence of what the alimentary tract can do, or might do, when by virtue of *non-absorption* it becomes a true eliminant, and we shall arrive best at this potential by examining the constituents of the several secretions which are poured into the alimentary canal, viz., the saliva, the gastric juice, the secretions of the pancreas and liver, and the intestinal juice. These secretions are all abundantly watery, and by failure of re-absorption, the bowel can on occasion throw out a large amount of water, and in this way supplement a deficient elimination of water by other channels.

¹ Schäfer, *op. cit.*, pp. 473, 474 *et seq.*

Analysis of the above-mentioned secretions give the following results :—

The Saliva.—The volume of the saliva has been estimated by Bidder and Schmidt as 1,500 c.c. for the twenty-four hours.¹ The solids of this secretion amount to 5·8 per cent. ;² these include epithelia, mucin, ptyalin, albumin and salts : among the organic salts we find recorded traces of urea.³ According to B. Moore (Schäfer's "Physiology") the trace of urea seems to be a matter of some uncertainty in health, but the statement follows that *pathologically* the amount of urea may become very appreciable.

The Gastric Juice.—This fluid contains, in addition to its inorganic constituents, with predominant acidity, traces of proteid, which on standing, suffer conversion into albumoses and peptones, also traces of mucin and the two enzymes, pepsin and rennin.⁴

No mention is made, by the authority quoted, of traces of urea, but Landois⁵ says that in uræmia ammonium carbonate is discovered in the gastric juice, a find very suggestive of urea elimination, at any rate in disease.

The Pancreatic Fluid, like the saliva, is very watery, and it is secreted in considerable quantity. Its volume and its composition seem to vary very

¹ Bunge, *op. cit.*, p. 153.

² Landois, *op. cit.*, p. 276.

³ See Landois ; also Schäfer, *op. cit.*, p. 344.

⁴ Schäfer, *op. cit.*

⁵ *Op. cit.*, p. 307.

greatly according to its source, viz., from temporary or permanent fistulæ.¹ Beside proteids and three enzymes, small quantities of leucin, fat, and soaps are found, also inorganic salts, in particular chlorides of the alkalies. Leucin is a possible representative of urea, according to Hammarsten, but perhaps more to the point is the stated occurrence of urea in the pancreatic fluid in disease, to wit, in jaundice.²

The Bile.—Considering the size of the liver, the biliary secretion, 400–600 grms. in the twenty-four hours, is astonishingly small, for it has been calculated that the parotid gland secretes in the same period from 800–1,000 grms.—yet this latter organ is little more than the one-hundredth part, by weight, of the liver.³

As Bunge says, this simple fact alone should have suggested that the liver must have other important functions to perform. However, it is the bile which now concerns us, and we note that its constituents are, a mucin-like body, the bile acid salts, bile pigments, cholesterin, lecithin, fats, soaps, *urea* and inorganic salts. These bodies, from cholesterin on, are in small quantities only, and urea occurs but in traces.⁴ According to Hammarsten, p. 132, the amount of urea in bile has been found considerably increased in uræmia.

¹ Hammarsten, *op. cit.*, p. 168.

² Landois, p. 318.

³ Bunge, *op. cit.*, p. 168.

⁴ Hammarsten, Landois, *op. cit.*

The Intestinal Juice has not been estimated accurately as to quantity ; it contains proteids, and ferments, mucin (especially the large intestine), inorganic salts, more particularly chloride and carbonate of sodium, and, according to the experiments of Pregl,¹ by means of artificial fistulæ, a small amount of urea. Even if we accept these experiments as establishing a morbid state (catarrhal) of the intestine, the significance of this leakage of urea is scarcely lessened.

This completes the list of the alimentary tract secretions, and one and all they indicate, by their component parts, the powers of this tract as an organ of excretion, in those cases in which, through an imperfect absorption, or an accelerated peristalsis, or an excessive secretion, a larger proportion than usual of the bowel contents will escape from the body.

Reviewing these same secretions, we are struck by the fact, that whereas each differs from the other by the presence of certain characteristic constituents, which represent the anabolic activities of the part in question, each resembles the other in the presence of certain elements common to all ; these elements, essentially excretory, are the result of the katabolic activities of the tissues of the whole body. Thus the ptyalin, pepsin, pancreatin, etc., are akin to the internal secretions of the ductless glands ; they characterise specifically the organs which

¹ Schäfer, p. 557.

elaborate them; they mark the differences: on the other hand, the resemblances are to be found in the qualitative likeness of the products of excretion proper, such, for instance, as urea, and though in *health* this likeness may quantitatively be minimal only, in *disease* its real significance becomes manifest.

Extending the survey to the other secretions of the skin, the kidneys, and the lungs, we note again both differences and resemblances. The specific differences here, however, are quantitative only, not qualitative; it is the same group of waste products which appears, but it is now this ingredient, now that, the elimination of which is accentuated. Whether these organs do also make positive contributions to the tissues, *i.e.*, whether they have internal secretions as well, this we must leave to the physiologists to determine.

We have said that it is disease which makes plain the reason of the similarity in the *nature* of the excretory products of these several organs; for instance, in health the elimination of urea is a negligible quantity except in the case of the kidneys, but in disease the saliva, the vomit, the pancreatic fluid, and the bile, may all show appreciable quantities of this substance.¹ As to its presence in the intestinal juice we have little direct evidence,

¹ In the vomit we may find either urea itself or carbonate of ammonium. It will be difficult to exclude the saliva as the source of this urea (Fagge, vol. ii. p. 454).

since its occurrence in the bowel contents may be referred to the above sources, but the experiments of Pregl make it probable that in disease urea is separated in increased amount in the succus entericus. In disease again the skin may throw out urea in such quantity that it shall appear as a powdery deposit on the surface.¹

Lastly, though we have little evidence of the elimination of urea in the breath, the lungs may in uræmia become a channel of exit, as shown by the presence of urea in the expectoration, pneumonic or bronchitic.²

The evidence therefore is conclusive, that by the vicarious activities of other organs renal inadequacy may be compensated for, more or less, and thus the excretory balance of the whole system upheld.

Since all organs which are in touch with the surface, whether internally or externally, are thus seen to be more or less permeable to this or that constituent,—water, carbonic acid, urea and other salts,—the whole excretory outflow may be pictured as an escape along lines of greater or less resistance, the flow being of course inversely as the resistance. In respect of urea the kidneys in health present the paths of least resistance, and along these the flow takes place in full stream. Along other paths, as of the skin, and of the alimentary tract and its

¹ This has been observed in Bright's disease and Cholera. Cf. Fagge, Landois, and Schäfer.

² Fagge, p. 457, 30 grains in 37 oz. of expectoration.

appendages, the resistance is relatively so great that minute leakages alone indicate their dormant powers ; they are, so to speak, short-circuited by the renal system. When, however, disease impairs this renal permeability, forthwith the conditions are changed, *relatively* the resistance along other paths is now lessened, and under the increased head of urea pressure which has gathered behind the kidney obstruction, these less used paths are forced open into channels of relief, more or less free.

The vicarious activities of the excretory organs thus constitute a reserve system which guards against failure, temporary or persistent, and if these organs severally be looked upon as parts only of one great excretory system, then these collateral activities may be viewed as the exact counterpart of the anastomotic channels of the circulatory system.

By the way, it may be here noted how it is that the organism as a whole secures its excretory stability, namely, by *not carrying* to the extreme the process of differentiation through which the higher types of tissue have arisen. It is thus by a beneficent conservatism, by a keeping in remembrance of the all-round powers of the ancestral protoplasm, that there is maintained a potency which in times of stress shall serve.

If we add to these considerations the evidence forthcoming that each excretory organ in a healthy state works far below its powers, and that at need

a small part of the organ can perform the duties which in the daily routine the whole organ performs, we shall gather how broadly and how deeply nature has built the foundations of life.¹

There remains for examination that other form of balance which depends upon the anabolic activities of the tissues. This balance is the result of positive contributions, as represented by the internal secretions of the tissues and organs throughout the body. Life is here the resultant of these component forces, the thrusts of which combine to effect the movement and upholding of the whole. In the case of the excretory balance which we have been discussing, we were concerned with the removal of waste products, which, themselves the result of a process of tissue degradation, conflict with the vital powers, and must therefore be got rid of as quickly as possible. Now we are considering those syntheses which are essential to the processes of life, are indeed part and parcel of them.

In this department of physiology and pathology our knowledge is of more recent date, and it is still very incomplete. We know, for example, that the liver, besides secreting bile, is specially concerned with the metabolism of carbohydrates and of proteids, also of organic iron-containing bodies; that the pancreas, besides furnishing important

¹ "The results following partial nephrectomy, and the influence of the kidney on metabolism," J. Rose Bradford, *Journal of Physiology*, vol. xxiii., 1899.

ferments to the alimentary canal, supplies a something which directly influences carbohydrate transformations, and this by way of an internal secretion; that the kidneys have to do with proteid waste in the tissues, quite apart from their nitrogen-eliminating powers; that the ovaries and testes, stand in some peculiar relation to general nutrition in addition to their relation to the development and activities of certain other organs.¹ We know also that the thyroid gland is intimately related to the nervous and vascular systems, to the heat-regulatory mechanism, and to the connective tissues, inasmuch as the removal of this gland by operation, or its more slow destruction by disease, is followed by perverted action in each of these systems. Further, we have evidence of a close relationship between the suprarenal bodies and the maintenance of the general muscular tone, as well as, and more particularly, of the vascular tone.

In each and all these cases, however, we know too little to justify speculation at length upon possible relationships between these synthetic activities, and yet there are one or two aspects of the subject to which attention may be drawn. In the first place, there is an obvious difference in the nature of the problem which confronts us, when we pass from a failure in an excretory function to a failure in an internal secretion. The former makes a direct call

¹ See Schäfer's "Physiology" upon these points, pp. 936 *et seq.*

upon every tissue whose functions are akin to those of the organ obstructed, inasmuch as the failure to withdraw leaves an excess of the waste product within the system; this plus quantity must exert a positive outward tension, which, striving for egress at every possible outlet, will force a passage here or there in the manner already described.

On the other hand, the failure to produce a given synthesis is an instance of a deficit, a minus quantity, and it is less clear how this negative shall make a direct call upon other organs. If we look at the matter closely, however, we shall see that this deficit must give rise to a stress of some kind, for if we are dealing with an equilibrium struck by a group of converging thrusts, the withdrawal of one of these thrusts must cause a strain which will occasion a rearrangement of the field of forces,—a call of some kind will have been made. But can we not get a little nearer than this to a working hypothesis? If it is by a process of evolution that the highly specialised tissues and organs have acquired their powers, does not this imply the possession of the germs of these powers by the ancestral protoplasm? How else can it be, unless we are prepared to see in these elaborations of function real creations, and a repetition of that process described by John Wilmot, Earl of Rochester, of seventeenth century fame, “when Primitive Nothing, Something straight begot.” But if we grant the possession of the germs of all functions by

the parent cell and see in specialisation only a development of these germs, then shall we not look in the cells of every part of the body, even in those least specialised, for evidence of these rudimentary powers,—can we escape this conclusion? Granting, then, that every cell possesses in embryo such potencies, and that these potencies can be developed, let us represent by the figure 100 the synthetic power of a specialised cell, and by the figure 0·1 the synthetic power of a cell of lowest order (of course we refer to one and the same synthetic product): these figures will then represent the synthetic tensions within the two cells. Now it is conceivable that in health the 100-power cell shall so saturate the system at large with its own specific product, that the potency of the 0·1-power cell shall be entirely hidden, in fact the saturation of the system may be such that the tension outside the 0·1-power cell may be in excess of that which is within it, and the cell may receive instead of imparting. In this last case, the cell will come to rely upon the outside supply for the particular potency in question, and its own feeble powers, instead of being stimulated, will tend rather to atrophy. But now suppress, no matter how, the 100-power cell, forthwith the tension throughout the system will fall from saturation point to levels of such tenuity, that the activities of the 0·1-power cell shall begin to appear as feeble glimmerings, the cell first saturating its own microcosm, and then overflowing into its surroundings.

With the demand, the activities will grow, according to the law of life, and the O·1-power cell will begin to ascend the scale of potency, though we shall not expect that within the limits of a lifetime it will travel very far.

If such considerations have any truth, then we shall err in limiting to this or that cluster of cells this or that synthesis, and the powers which we represent by such terms as pepsin, ptyalin, pancreatin, will belong to all cells more or less, how rudimentary, how difficult to demonstrate quantitatively, will be beside the mark.

But if this is so, we have here the groundwork for a vicarious action in the field of synthetic productions, and we discern a unity of plan in the working of the body, both in its building up and its pulling down. In actual evidence of such probable vicarious action we have the facts of splenectomy.¹

To complete the argument we must point out that in the case of the internal secretions, as in that of the excretory functions, we have ample evidence that in health each organ is capable of a much higher activity than it exhibits in a routine way. Thus we know that if the thyroid gland be wholly removed, a certain train of symptoms follows, but that if only a *small portion* of the gland be left behind, or there happen to be present an accessory thyroid which has escaped the surgeon, these

¹ Schäfer, *op. cit.*, p. 960.

symptoms do not occur. Bradford's experiments upon partial removals of the kidneys will belong here if the gland has an internal secretion, also the experiments upon the relation of the pancreas to diabetes, it having been fully established that the retention of but a fraction of the gland suffices to prevent the diabetes which inevitably follows its complete removal.

Thus again and again does disease teach us the same facts, for the spoiling of organs, compatible with the persistence of life, may reach degrees positively astounding. We have said nothing about the duplicature of organs and the added stability thereby secured, nor, except incidentally, have we referred to the significance of accessory bodies, such as the accessory thyroids, suprarenals, and the spleniculi.¹ These facts must be surveyed together,

¹ If we regard the leucocyte as a product of secretion, and the leucocytic invasion upon the entry of an irritant as an instance of protective reaction (see the experiments of Metchnikoff, "The General Pathology of Inflammation, Infection, and Fever," W. Ainley Walker, 1904, p. 9), then the inter-relations of the various leucocyte-forming organs and tissues—spleen, lymphatic glands, red bone-marrow and lymphoid tissues—will give another instance of balance. It is not necessary to probe more minutely into the mode of operation (probably chemical) of the leucocytic response; it suffices that this response is designed to meet an attack upon the integrity of the body.

In like manner the antibacterial powers of the blood serum, as measured by the so-called "opsonic index," will furnish another example of functional equilibrium; for the *opsonins* upon which these powers are held to depend must

along with the phenomenon of compensatory hypertrophy, in order that we may realise how the structure of the body declares the handiwork of the great Designer.

With these brief considerations we touch the fringe only of an intricate subject, the chapter on the inter-relation of the ductless glands, and of the internal secretions generally, having yet to be written. Until more is known it is vain to theorise about particulars—we sail the high seas with *Æneas*, “undique pontus, undique coelum,” possibilities without end around us, nowhere sure and certain guidance.

derive from the tissues of the system generally, and we must conclude that the tissues can each supplement the one the other, should the opsonic index for this or that organ fall below its normal.

With regard to these opsonins it is unimportant from the point of view of the present argument whether they act by stimulating phagocytic action on the one hand, or upon the other hand by depressing the vitality of the infective bacteria, thus rendering these an easier prey; it is sufficient that the opsonins form part of the “machinery of immunisation” and that this machinery will include all parts of the body.

The work of Professor A. E. Wright and of his collaborators in this field of investigation seems to promise results of the highest value both in the diagnosis of disease and also in its treatment: in respect of the latter by offering us, as it were, a means of standardising the body in relation to its power of resistance to toxins of all kinds.

CHAPTER IV

PRIMUM NON NOCERE

"Ne quid detrimenti respublica capiat."

THE preceding considerations on physiological and pathological balance make no attempt at being exhaustive ; they are illustrative rather, and intended only to enable us to realise more fully the nature of the therapeutic problems before us. We have therefore now to ask, What do they teach, how do they help us to approach the question which each patient puts to us individually, what is to be done?

In the first place, we learn that, whenever the equilibrium of health is disturbed, the organism tends to swing back to the normal, in other words to right itself, and further that however great the perversion may be, the organs and tissues never lose wholly those activities which characterise them and which are, so to speak, inherent. If this were not, all our endeavours at treatment were vain : we class our medicines as soporifics, as cardiac tonics,

as cholagogues, and so forth, but there is no drug which we possess which contains a grain of sleep, though we have many which will assist that bias of the tired cell; neither have we any heart tonic which can do more than facilitate the contractile powers of the muscle fibres, it brings with it no contractility, *per se*; no cholagogue ever did more than promote the bile-forming activity, which characterises the hepatic cells as essentially as the power to attract the needle characterises the magnet. Favourably or unfavourably, our *materia medica* can only condition the manifestation of activities which they are absolutely powerless to create, and this being so, our first lesson is the time-honoured precept, *primum non nocere*, to take heed in the first place that we do no harm,—that there is no interference with a natural salutary movement.

The intimate relationship which we have seen to exist between the various parts of each system, and between the various systems themselves, considered as units, necessitates the complicated adjustments which we have instanced as examples of stability or balance, and just as we are wholly powerless to create the vital manifestations of the tissue elements, so, in like manner, we are powerless to create relationships which do not already exist. We may be able to modify, increase or diminish, the internal workings of the several organs themselves, also the interaction of these organs one upon the other, but with this we reach the limits of our powers: we can

establish nothing new. We must even go further, and confess that in a large proportion of diseases we cannot with advantage modify the interaction of the several parts of the body, at least in essentials. Thus we may safely leave it to the heart how it shall best meet an obstruction by hypertrophy, to the cerebral hemisphere how it shall effectually take up the impaired functions of its fellow, to the accessory thyroid how it shall assume the duties of the main body of the gland,—this latter having been removed by disease or the knife,—to the leucocytal system how it shall respond to the microbic invasion. Knowledge such as this has been acquired through long ages, and, as the result of trials innumerable, has become ingrained. Thus repeatedly is the lesson enforced, *primum non nocere*, lest we interfere with that automatic self-regulation, which, in the majority of cases, makes for safety.

The recognition of the equilibrium of the body did not escape the observation of the ancients—indeed, so impressed were they by the tendency to recover from injury or disease, that they concluded there must reside somewhere in the tissues an active remedial principle; to this they gave the name of the *Vis Medicatrix Naturæ*. Not inaptly does this name describe that balance of the organism, the outcome of multitudinous stresses, which enables it to weather the average of life. In the *vis medicatrix naturæ* we shall, how-

ever, see only those reserve powers, those potentials, with which the tissues are endowed in order that they may meet emergencies; powers in excess of the ordinary needs of life, which, like the ballast of the ship, may be called upon to right the vessel during the progress of the storm, and after it has spent itself. We shall not see in it any positive active principle which makes for health.

Within this principle lies the secret of the success of many of the systems of treatment which have prevailed from the past down to the present, and which still prevail. Every healing method relies upon the powers which this name covers, without them can do nothing. The *vis medicatrix* has floated many a false system of medicine, including some very heavy craft: *it* has cured, *they* have claimed. On the other hand, these same powers constitute a great difficulty in the valuing of any given treatment, and they are responsible for much of the scepticism which has been, and still is, in respect of the remedial powers of the *materia medica*. The problem, indeed, is one of exceptional difficulty, for it does not suffice to have shown that under a course of treatment the patient has recovered; we must go further and demonstrate that the recovery has been more complete, or more speedy, than it would otherwise have been.

Whether we work for or against the powers of

nature, the recognition of our efforts, be they auxiliary or hostile, is difficult in proportion to the strength of the *vis medicatrix*. If the set of the current healthwards be strong, the aid or opposition which we supply may not appreciably accelerate or retard the natural movement. And how strong this movement can be we realise when we read how Machaon, when sorely wounded in the Trojan wars, was regaled with Pramnian wine and cheese and onions and meal (this last, without doubt, some kind of dough).¹ True, we hear that this great surgeon did not survive the wars, but one must presume that he was treated upon accepted lines, and that this surgical fare could not have been so fateful as it sounds, or would Troy have fallen?

It is necessary, however, that this aspect of the subject, viz., the potency of the *vis medicatrix*, should not blind us to another view of the complicated powers of the system. Not always do the workings of the body appear to make for health, nay more, those very workings, which in general we regard as salutary, seem at times to endanger the whole organism. Thus in the case of laryngeal disease the looseness with which the mucous membrane invests the cartilaginous structures, and by virtue of which the free movements of the cartilages are possible, may itself become a serious danger, for if inflammation arise, an œdema of such magnitude may ensue, that unchecked it promptly

¹ Sprengel, "Geschichte der Arzneykunde," vol. i. p. 162.

leads to asphyxia. The inflammatory reaction here is none other than that with which we are familiar in every part of the body under similar circumstances, but life at the larynx being, so to speak, in the narrows, a swelling, elsewhere of no account, is here a matter of life and death. Under such possibilities, we might have expected that œdema would be more difficult than elsewhere, yet structurally it is more easy. We may admit that the perilaryngeal tissues are not prone to develop œdema, but the point is that if œdema does arise, the structural peculiarities multiply the consequences instead of minimising them. Again, the firm fibrous casing of the eye is doubtless an essential to the functions of that organ by the maintenance of a definite globular shape, without which its special refractive powers could not be exerted—moreover it serves a distinct protective purpose. But let inflammation arise, or a tendency to effusion into the cavity of the eyeball, and the unyielding nature of the casing multiplies, to a most dangerous degree, the peril to the delicate nerve structures within. It is thus that in acute glaucoma we see a reaction, elsewhere harmless, acquire a violence fatal to the part.

Another example may be taken from the vascular system. At the valves of the heart inflammation in all its stages may be witnessed, though its naked-eye appearances differ much from those occurring in more vascular parts; but whereas in many such

parts of the body we regard the inflammatory process as distinctly compensatory, and recognise in the granulation tissue a means of isolating or limiting a morbid focus ; of bringing together and cementing parts separated by disease or injury ; of fixing and so restricting the movements of one part upon another, after the manner of a splint in surgical affections ;—whereas we recognise that granulation tissue may serve all these desired ends, we take note in the instance of an inflammation of the valves of the heart, of a movement, harmful it would appear in all its stages. Thus, in the earlier stages the vegetations will obstruct more or less, and in addition, by preventing accurate approximation of the edges of the valves during closure, they will cause more or less incompetence, whilst in the later stages of subsidence and healing, the fibroid changes which attend, will, by the retractions, puckerings, and rigidities produced, cripple still further the valvular structures. True, the endocardium is not prone to take on inflammation, and this relative immunity gives relative security, but once inflammation has arisen, the mischief it produces is aggravated rather than thwarted by the special conditions which obtain. The accidents which may arise from the formation of clottings on the inflamed valves, and the detachment of these, must be added to the list of dangers.

This subject is capable of indefinite development, but we must be content with these few examples,

which tell us that the response to disease is sometimes distinctly unfavourable from the very beginning. We shall note that this is more liable to be witnessed in those parts which have reached a high degree of specialisation, and that when such specialisation takes place within the area of a vital function, life itself is in jeopardy. But if this is so, we must look most carefully at each case in order to see what is the natural trend of events, whether, as in a majority of cases, the reaction is healthwards and the expectation of life, for the part or for the whole, good, or whether, on the contrary, we are face to face with a vicious circle of interactions which must be broken at all costs.

Non nocere, then, does not epitomise the duties of the physician, the qualification *primum* is essential. Not to harm is clearly our first obligation, and it is equally clear that it holds whether the primary reaction is favourable or unfavourable, for in the latter case it is always possible to make matters worse; but on every occasion to stand by with hands folded, at most limiting our endeavours to a strict non-interference with the play of forces before us, in the expectation that all will be for the best, this, the practice of the Stahlians, is a *reductio ad absurdum*, and it has been fittingly styled a "meditation upon death."¹

¹ Paris, "Pharmacologia," *op. cit.*, Historical Introduction, p. 30.

We must here anticipate a possible objection to these statements: it is not contended that in such parts as the eye, the larynx, the heart, the actual *tissues* show no tendency to recover, the *vis medicatrix* in them is probably as strong as elsewhere, and if we can but get rid of the raised intra-ocular tension, or establish another airway, eye and larynx will then exhibit the usual tendencies. The inflamed cardiac valves, in like manner, could they only be removed from the disturbing influences of the flux and reflux of the blood-stream, would show us the same recuperative powers: the mischief lies, not in the materials of the tissues, but in the morbid vantage which structure in each instance has conferred upon disease.

To conclude this part of the argument, we may now give some examples of the application of the *primum non nocere* principle, premising only that in each and every case, no matter how stable the equilibrium, the question of a *vis medicatrix* depends upon the intensity of the disturbance, and that if this transcend a certain degree, the balance is irretrievably gone,—the damage irreparable.

The first application of the doctrine of non-interference arises out of the consideration of the body as a masterpiece of design. If it really be such, then it is our primary duty to retain as much as possible of the original structure. Surgery must come in, there is no way out of this; the body must

be lopped and pruned, but upon this view it will be the policy of the surgeon to keep, to preserve, every atom of the organism *which disease has not condemned*. Conservatism will be his guiding principle, and thus if he cannot keep a whole movement he will keep a part; if he cannot keep a whole organ he will keep a rudiment, no matter how insignificant it may appear. It will be a policy of leavings, as against the methods of the charwoman, embodied in the clean sweep: neatness will thus have to yield to a studied untidiness. At the operation the formal, the set, the prearranged, will have to give place to the informal, the unfettered, the conditional.¹

Perhaps no more striking instance of the value of remainders can be adduced than that furnished by the surgery of the thyroid gland in connection with the development or not of the Cachexia Strumipriva of Kocher. The facts, then, of the internal secretions demand that here also, each case being judged upon its merits, the question of the preservation of healthy remainders should be carefully weighed; otherwise stated, this teaching implies the careful restriction of the operative area to the limits of disease.

The second application of the *non nocere* teaching

¹ The late Mr. Marcus Beck used to insist upon the principle of conservation in surgery, especially in operations upon the limbs, and upon the hand in particular. His old students will recall with gratitude his wise teachings.

covers a wide area ; it is the application of the principle of rest.

Examples, in long series, might be furnished of this method of treatment, which aims at warding off all disturbing forces, in order that the natural powers of the body may act without let or hindrance ; a few instances will answer our purpose, such are :

The use of the surgical splint in the treatment of the broken limb ;

The fixing of the chest by strapping or other means, in acute pleurisy ;

The use of the bed or couch in heart failure in all its forms ;

The treatment of the gastric or duodenal ulcer by a bland diet or by the temporary complete suppression of feeding by the mouth ; also the more active treatment of the same conditions by a gastro-enterostomy, whereby rest to the ulcerated parts is secured ;

The use of a milk diet, predigested or not, in the treatment of an ulcerated intestine, as in typhoid, or of a local peritonitis, as in appendicitis ;

The isolation of the neurotic patient ;—the removal of all possible disturbing elements in the case of tetanus or hydrophobia ;

The darkened room in eye affections ; the use of tinted glasses to moderate the light ; the em-

ployment of lenses to correct errors in refraction, and so give repose to the overworked mechanism of accommodation.

Rest may thus be secured by mechanical means, or by the help of chemistry, or by calling upon our knowledge of physiology, as when we treat all forms of exhaustion by complete repose of body and mind. At one time a simple withdrawal will attain the end in view, as when by the suppression of gastric feeding we treat a gastric ulcer, at another time the active measures of an operation will be necessary, *e.g.*, a gastro-enterostomy in the same affection ; or we may have recourse to opium in order to check a peristalsis in inflammatory states of the alimentary tract, or its peritoneal covering, or to check the cough of a pleurisy : thus passively or actively we shall secure the object we have in view. The application of the principle of rest may be *direct*, at the morbid focus itself, as, for instance, when we tie the artery supplying an aneurysm, or give suitable glasses to the presbyopic eye ; or it may be *indirect*,—a demonstration in force at some distant point, as in the use of the purge and the diaphoretic in acute inflammation of the kidneys. Passive or active, direct or indirect, the means we adopt are calculated to bring about a condition of rest at the site of the disease itself. This involves a lessened demand upon the damaged tissues, a saving of the vital powers locally, the opportunity for the storage,

locally or generally, of force and material wherewith to build up tissue and potential.

Before leaving this subject of rest it will be well to consider an issue which, although aside from the main argument, is of real importance, and is involved in all rest cures. The health of the body as a whole or in part demands a certain relation between rest and activity ; this is a primary physiological truth. This relation cannot be disturbed without detriment to the economy, and hence the prolonged rest, which many cases of disease or injury necessitate, is by no means an unmixed benefit. Evils—minor ones it may be, but still evils—are liable to attend upon the rest cures, and this has led to various modifications of treatment, the object of which is in each case to secure the advantage of rest at the least cost. Surgeons have long grudged the price which they have had to pay for the firm union of the fracture, in the wasting and stiffness of the muscles, with the probable addition of adhesions, all of which have resulted from the immobility caused by the splint, and it is the recognition of these drawbacks which has led to the introduction of local massage, along with splint treatment, in the cure of fractures. Should the nature of the injury be such that an enforced idleness of the whole body is necessitated, the above treatment may be supplemented with great advantage by general massage, along with passive and resisted movements.

Similar considerations arise in respect of the treatment of heart failure by rest in bed. None who have observed the effects of such treatment can doubt its efficacy, yet in no class of disease has a remedy been more abused, to such an extent indeed, that, applied without proper discrimination, it may be said to be an evil, less only than that for which it is prescribed. A better acquaintance with the reserve powers of the heart, a clearer recognition of the essential dependence of health upon activity as well as upon rest, these have led to the introduction of muscular exercise in some form or other as a definite curative agency in heart disease. The secret of success lies, will always lie, in the due apportioning of these two factors, repose and activity, to the needs of the individual case: rest, as absolute as we can make it, will not be in excess of the requirements in the extremer forms of heart failure, but there will be few cases in which gentle rubbing will be inadmissible, and with returning compensation this may give place to a more definite general massage with passive movements, whence we may rise up the scale through slight resisted movements to Oertel's graduated climbs. On this ascending scale we shall recognise for each case individually, a certain level, higher or lower, as the highest attainable. This level will represent the maximum of activity which the circumstances of the case permit, and the ratio of this activity to the amount of rest which it demands, will express

the health of the individual. We may put this in the shape of a formula, thus :

$$H = \frac{A}{R},$$

in which H = the health of the individual,

A = the amount of activity of which
he is capable,

R = the amount of rest needed for
recuperation.

In this formula we read that the health value is directly as the activity manifested, inversely as the quantity of rest needed to develop this activity : if it be remembered that rest means storage, it will be seen that this must be so, and that this formula holds true, not only for disease but for health also. In the case of the broken limb, all that we desire to secure is the apposition of the separated fragments ; in the case of the failing heart we would, if we could, rest the heart alone, but the circumstances forbid this restriction, and we are often compelled here, as elsewhere, to paralyse the functions of a wide area of activity in order to treat a limited focal trouble. To minimise this difficulty is our serious duty.

With regard to the importance of the relation between activity and rest, considerations of a somewhat different kind apply when the functions of the organ in question are distinctly intermittent. This may be well illustrated by the process of alimentation, in which the principle of rest is not less fundamental than elsewhere. In two ways we have it in our power to enforce this principle—

first, by regulating the intervals between the meals ; and secondly, by regulating the quantity and quality of the food administered. Speaking generally, the more crude and strong the *quality* of the aliment, the longer must be the period of rest allotted ; the latter being more or less in direct proportion to the digestive effort demanded. The like will hold in respect of the *quantity* of the meal, digestive vigour being measured directly by the robustness of the fare (in quality and quantity), inversely by the digestive interval. Some forms of weak digestion associated with a fair amount of general vigour we shall best treat by lengthening out the interval between the meals (one form of rest cure) ; other forms of dyspepsia we shall meet better by altering the quality of the food, so as to lessen the digestive effort. The problem of nutrition is oftentimes a very difficult one, for the feebleness of the digestive organs may happen to be associated with a very prostrate state of the system generally, the latter calling for an abundant supply of nutriment. In such cases it may be necessary to predigest the food so as to reduce to a minimum the digestive reflex, and enable us to shorten the fasting intervals ; in this way the mucous membrane will have little else to do than absorb, and without undue fatigue we may increase the frequency of food administration. A rich, nervous supply places the alimentary tract and its appendages under the influence of multitudinous impulses, arriving from all parts of the

body, and in consequence digestion becomes a very complicated act. This explains how it is, that though we may claim to some advance since the days of Machaon, when cheese and onions represented the regimen of the wounded hero, yet even now the dietetics of health and disease are so little comprehended. For the moment, then, we must content ourselves with insisting upon the methods by which we can apply the principle of rest to assimilation, viz. : I. by regulating the length of the fasting interval ; II. by modifying the digestive coefficient of the meal, qualitatively and quantitatively.

The use of the term "regulating," is intended to convey that whatever the interval of fasting selected, this interval should as far as possible be maintained, because of the rhythmic nature of the process.

Upon these lines having reached this or that level in the return towards health, we shall endeavour to make further advance by increasing the robustness of the meal, in quantity or quality, and by lengthening out the digestive interval until the average of health has been regained.

Unless this course be pursued here, and indeed in every form of rest cure, we shall be in danger of that Nemesis of rest, to wit sloth ; the laggard stomach disinclined, the disused nerves and muscles unwilling, the mind engaged in passing the time instead of in occupying it, unfit for any strenuous effort, the will power unaccustomed to assert itself, inert : these are the fruits of rest run to seed.

The multiplication of homes and sanatoria, and of all the apparatus for effortless existence, conceal this great danger ; it behoves us to be alive to this, lest we forget that health,—spiritual, mental, and bodily,—means effort.

There remains for consideration a third application of the text, *primum non nocere*, to which, in a preceding part, allusion has already been made ; we refer to the *non*-correction of a symptom which is of the nature of a reaction favouring balance.

The excessive flow of urine in Dr. Strange's case appeared to be an example of this (*cf.* p. 5). The diarrhœa which often attends the uræmic state seems to be of a similar nature, a symptom which one hesitates to interfere with, unless very excessive, on the ground that it may be, and probably is, in part eliminatory. The arthritic manifestations of the gouty paroxysm are regarded by many as of the nature of a safety-valve action, to be encouraged rather than suppressed in view of the serious symptoms which may attend the appearance of gout in the internal organs. The older writers are very insistent upon the dangers of suppressed and of retrocedent gout, and they certainly had a very large experience of the disease in all its permutations and combinations, as well as in its frankest expression. Neither is their view an unreasonable one, namely, that the storm, if it has appeared, should be suffered to spend itself in a non-vital area. Even in these days of

scepticism few would care to risk the treatment of this variety of inflammation with the ice poultice. Again in the case of the pyo-pneumo-thorax of tubercular origin, we seem to have a compromise of a kind which requires the greatest caution in the handling. It is, perhaps, a stretch to call the state of things here found a reaction favouring balance, and yet we do recognise that a certain degree of equipoise, however unstable, has been established, and that it is compatible with life on quiet lines protracted for months or even years. It is the presence of the tubercular element which here gives pause, and which seems to determine disaster upon any rash treatment by free incision. In any case the treatment of the tubercular pyo-pneumo-thorax must be essentially an individual one and not upon general lines. What is true of this form of pyo-pneumo-thorax, is true in a modified way of the tubercular sero-fibrinous pleurisy,—it requires more individual consideration, more tolerance, so long as the effusion is moderate in quantity, with a careful weighing of all the circumstances of the case, before interference is decided upon. Again in suppuration within the cranium an external discharge through a “fistula of relief” may be a saving clause in an otherwise mortal argument.¹ This also is scarcely of the nature of a reaction favouring balance, but life is

¹ Jonathan Hutchinson, art. “Abscess of Brain,” Quain’s “Dicty. of Med.,” ed. 1894.

held upon these terms, and so long as the primary focus of disease is not accessible to direct treatment, we dare not tilt against the symptom.

These instances may suffice to show us how the compromise, in each case effected, is literally a *modus vivendi*, which we disturb at our peril unless we can reasonably see our way to life upon other and better terms.

CHAPTER V

SECUNDO PRODESSE

"Usque ad aras"

PART I

Positive treatment, its nature, time and place of application; treatment by antagonism or interference.

HAVING sought in the first place not to hinder, it becomes our next duty to assist if possible. Negative treatment, at best, however important it may be, will not satisfy therapeutic aspiration: we shall never cease to strive, *secundo prodesse*. In these two words are summed up the whole of positive treatment, but the development of their full significance lies in many chapters. The opiums, the quinines, the irons, arsenics and mercuries, the contents of Galen's garden and Paracelsus' scrip, are here upon their trial; they, together with every form of treatment which claims a healthward direction for the positive impulse

which it imparts. In the measure in which Medicine is able to make good this claim or not, it stands or falls.

To inquire, however, into the validity of the pretensions of each member on the list of the *Materia Medica* is outside the scope of these pages. Doubts, hesitations as to the efficacy of this or that remedy, do not concern us: our task is to examine upon what principles we shall employ *those remedies*, be they few or many, *in which we have faith*.

We have seen that the *primum non nocere* is often attained by the use of active means, including drugs, and it is more than likely that it may prove difficult, perhaps impossible, to say whether in a given case our treatment belong here, or more strictly to the *secundo prodesse*. The matter is of no practical importance, so long as we are clear in our own minds what it is we have to achieve, and how.

We proceed, then, to the discussion of those forms of treatment which admit of no doubt as to their positive nature. The occasion for remedies of this class arises when for one reason or another the recuperative powers of the system are of themselves insufficient, the healthward bias of the tissues being either wholly inadequate or too laggard. Newton has laid it down in his first law or axiom—"that all bodies tend to persist in their condition of rest or of

movement, unless, under the impulsion of some new force or forces, they are constrained to change that state." ¹ This law, which is fundamental in physics, underlies equally all manifestations physiological as well as pathological ; it is a statement of the inertia of bodies, of universal application. If, then, we witness in all living organisms a tendency to revert from a state of disease to a state of health, this obtains by virtue of that special build or conformation which we have named balance, and it obtains, in spite of that tendency to persist in ways good or evil which is fundamentally the property of the tissues. In all organisms worthy of the name, this conflict is observed daily either *in esse* or *in posse*, the word organism, itself, implying a building up of potencies of greater or less ability to withstand disturbance of any kind. But when the potencies which make up this balance, or *vis medicatrix nature*, run low and are too feeble to overcome the inertia of disease, then it is that we are obliged to go outside the existing field of forces, and bring in those new powers which shall compel a change of state.

Do virtues such as these reside in the kingdoms of nature? To doubt this, is either to deny to herb and mineral or other natural product the possession

¹ Corpus omne perseverare in statu suo, quiescendi vel movendi uniformiter in directum, nisi quatenus illud, a viribus impressis, cogitur statum suum mutare.

of any properties at all, or to credit them with powers for evil only, thus dividing the house of nature against itself.¹ But surely this is a *reductio ad absurdum*, and by the method of Euclid we are justified in concluding that such healing powers do exist and are for our use: the question therefore now follows, how shall we utilise them?

When in malaria we have recourse to quinine, or in specific disease administer potassium iodide, or mercury, or both; when in anæmia we give iron, in acute rheumatism the salicylates; when in heart failure we give digitalis, and in psoriasis arsenic, and so forth: we apply to each particular disturbance that particular impulse which experience has found to be efficacious, and in so doing we practise an empiricism, pure and simple, in the honest sense of the word. For whether these affinities have been revealed to the chance observer or to the patient watcher, in either case they are the fruit of observation, and deeper than observation we cannot get, since affinities reduced to their simplest expression are elemental, and capable only of observation and of record.

From this point of view the science of the *secundo prodesse* will be represented by a mere catalogue of diseases or symptoms, and of the remedies which correspond thereto. Thus, for

¹ "Ni deus affuerit, viresque infuderit herbis,
Quid rogo dictamnum, quid panacea juvat."
(Old inscription in the Apothecaries' Hall, London.)

example, a gastralgia will indicate bismuth and hydrocyanic acid ; a diabetes mellitus, which diet will not control, will call for morphia ; an epilepsy, for bromide of this or that, and so forth. Now, however useful this knowledge, it would be a sorry science and a still sorrier art, and the interest in the case would practically cease with the establishment of the diagnosis. But the body upon which these remedies are to act is a complex piece of mechanism, in many parts, and it exhibits a movement of its own, the sum total of many lesser movements of varying magnitude ; these movements greater and lesser are as characteristically rhythmical as "the pulse's magnificent come and go." Such being the case there must be points of vantage, both in time and place, for the application of the remedial forces, to the end that they may exert a maximum of effect. In other words, there is scope for therapeutic opportunity, and forthwith the science and art of medicine acquire a fuller meaning.

As has been already stated, the organism is so constructed, on the principle of *association*, that a general disturbance shall of necessity involve a local perturbation, and *vice versa* ; but it is also so constructed on the principle of *dissociation* that a local disturbance shall tend to maintain its localisation. Upon these considerations we conclude that where the principle of dissociation predominates, our efforts shall be mainly in the direction of local treatment ; that where on the other hand the

principle of association rules, a more general treatment will be indicated. The best results, however, must always be obtained by conjoining both forms of treatment. Here is a spacious field for the labours of the physiologist and pathologist, the determination, namely, of the relative dependence and independence of the several organs and systems of the body,—the recognition of the relative vigour of the communal and individual life of the part.

Trial alone can tell us upon which form of treatment we shall have to rely in a given case, but it would seem clear that in the first instance local treatment should be essayed, and that then only should we proceed to attack the system at large when the local means have proved inadequate. Thus, when in a case of headache from eye-strain we correct the refraction error by suitable glasses, or in neuralgia of the fifth nerve we remove the carious tooth which has been the exciting cause, the local remedy will probably alone suffice; but when in acute rheumatism or in scurvy rickets we attempt to deal with the local manifestations by remedies applied *in situ* only, we shall find that we are wasting time, and that to cure the disease we must treat the system generally. That in the last-named affections the local application may have some value as an adjuvant will not be denied.

In each case, then, the art of medicine will consist in the careful appreciation of the case and its

therapeutic indications, from the point of view of the *site* of application of the remedy; this application will be based upon experience.

Given the demand for systemic treatment, it may seem as though it must be a matter of indifference *where* the remedy gains access,—whether by skin or mucous membrane, or by direct introduction into the cellular tissue, or immediately into a vein. In certain respects this question is no doubt immaterial, but in certain others it is not; for in the first place the site of access will regulate to a great extent the rate of entry, and upon the relation between rate of entry and rate of exit, *i.e.*, excretion, will depend whether the new element, which we are introducing, can gather head or not within the system;—this may be crucial as to its efficiency or inefficiency. In the next place, according to the site of entry, so will be the route followed within the organism, and this will involve very different contact relations between the drug and the cells of the body in the act of absorption. Thus if a medicine be introduced by the skin it will pass through a layer of cells of comparatively low grade activity, into the functionally low grade areolar tissue, and through its lymph spaces and capillaries it will enter the blood-stream with some intercurrent filtration through lymph glands. But if a medicine gain admittance through the mucous membrane of the stomach or small intestine it will pass first through a layer of cells of high

grade function, with the products of whose activity it may make acquaintance according to the stage in the digestive and assimilative cycle; then it may pass through a rich lymphoid tissue, whilst such of it as shall enter the capillary networks will next come into relation with the mass of the hepatic cells; then only will it reach the general blood-stream. In these different routes, if contact with a protoplasm of more or less activity is likely to modify more or less the entering medicament, we may have some explanation (apart from the mere time element, rate of absorption) of the difference in action between medicines according to their site of administration. As examples of such differences we may instance the comparative harmlessness of curare when absorbed through the alimentary tract, its virulence when entering through an abrasion. The difference in this case is doubtless to a large extent due to the relation between rate of excretion by the kidneys and rate of absorption, but experiment suggests also that contact with the gastric juice may in part give explanation.¹ Another example will be furnished by the toxic effects of mercury when administered in the usual way, and when absorbed as a vapour; witness the special incidence of the drug upon the nervous

¹ Hale White's "Text-book of Pharmacology and Therapeutics," art. by Theodore Cash, p. 201. One may add that it will be difficult to exclude the modifying effects of other contacts, *e.g.*, with the hepatic cell.

system in the latter case with the production of mercurial tremors and palsies.

In time, it is to be hoped, we shall learn to utilise facts of this order ; and it is not unreasonable to expect that in those diseases marked by local manifestations which have proved most amenable to systemic treatment, however applied, we may secure even better results by introducing the remedy into the system *via* the local disorder,—the suggestion being that we may learn to make use of local contacts even in remedies the most systemic. In cataphoresis we have one amongst other means of causing a substance to flow through a given part into the system.

But now, given the demand for local, not systemic treatment, certain considerations present themselves according to the quality of treatment demanded. Supposing it to be a sedative influence we desire, then *direct* application will be the most obvious call ; for instance, the solution of cocaine in oil of cloves to the exposed and inflamed nerve pulp, the menthol soap to the itching skin, the lozenge of morphia or heroin to the irritable pharynx. In like manner if the disorder be a surface inflammation, in which, in addition to pain, we have to cope with certain vascular phenomena, then the poultice or fomentation, medicated or not, will be indicated. This kind of treatment is applicable also to more deep-seated troubles, in which the surface may take no share, and its value rests upon one very obvious

mode of action. There is a physiological saw which says, "Where there is an irritation, there will be an afflux."¹ This saw might be completed by the addition: thence (from that other part) will be a deflux,² since you cannot attract the blood to one part without withdrawing it from elsewhere. It is true that the mass of blood is not a fixed quantity, and that between the amount of fluid within the vessels and in the tissues, an ever varying ratio obtains; were it not so the statement would hold absolutely, but this notwithstanding, the attraction of blood to one region and its withdrawal from another will undoubtedly play a part, and the greater, the larger the area into which the blood is attracted. For reasons such as this we poultice the side in an early or threatening pleurisy, the abdomen in an incipient peritonitis. In either case we apply the remedy directly over the part affected.

When we have recourse to means such as these, we choose from among the irritant or stimulant members of the pharmacopœia the one most suited to our purpose. Some of these act very intensely, to the extent of vesication or pustulation, or of the production of even severer forms of inflammation, unless we control them carefully; others are comparatively mild in their action. In the benefit which we can obtain from this scale of stimulation, we are reminded of the law in physics, according to

¹ *Ubi stimulus, ibi affluxus.*

² *Illinc defluxus.*

which we gain in speed as we lose in power. This law might here stand, that we gain in area of application as we lose in intensity of effect ; for the more intense the local irritation, the more must we restrict the area of application, since we dare not vesicate or pustulate over too large a surface. In fact we are more limited in the intensity of effect which we can employ, than in the area available for irritation, and it follows from this that we can often get much greater effects by stimulating mildly over a large surface, than in irritating severely over the smaller surface at our disposal. A large poultice or fomentation may thus prove a more powerful derivative than the more circumscribed blister.

Not always do we apply the derivative directly over the part affected, for so long as we withdraw blood from the congested part, it does not matter to which part we conduct that blood,—at least that is the theory, and it is upon this theory that we purge in congestive states of the head, that we give a hot bath, or put the feet in mustard and hot water, in case of a chill threatening within the chest or abdomen. The term “revulsant” or “derivative” is applied indifferently to such action.

But when we treat locally, we do something more than either soothe or irritate the parts directly acted upon. The stimulus supplied falls upon nerve endings, amongst other structures present, thence it travels centripetally along nerve fibres, and, having reached the centre, it issues from it as an impulse in

some one direction or other. Part of the vascular effects described are the result of this projection of the impulse from periphery to centre, and back again from centre to periphery ; but are these the only effects produced, or may not, in this reflex way, trophic changes arise or suffer modification ?

There is a considerable body of belief in the possibility of thus indirectly influencing the functions of the various organs and tissues, and there is some experimental evidence in its favour, apart from clinical observations,—neither, in itself, is the view an unreasonable one : upon it rests the theory of counter-irritation. To make this theory of practical value, however, something additional is required, viz., that the reflex relations of the parts should be upon some well-defined plan. Now as to this, it has long been held that the deeper parts of the body do stand related to certain definite areas on the surface, and of late years the investigations of Dr. Head have strengthened this view. According to his findings the cutaneous nerves from a given skin-field having entered the spinal cord at a certain level, come into relation through the spinal ganglia with the viscus, whose afferent nerve fibres reach the cord at that same level. Hence, according to the segmental representation of the skin and viscera in the spinal cord, so is their relation the one to the other. Upon this plan of construction it should be possible to project a stimulus at will upon a given viscus, and therapeutically to secure its influence

for all it may be worth. Precisely what this value is we must leave for future investigations to determine. We are familiar with the various forms of counter-irritation over the apices of the lungs in early phthisis, with the blister to the epigastrium in irritability of the stomach, or to the temple in iritis. The value of counter-irritation is "recognised by all practical surgeons,"¹ though its mode of action be difficult to explain. Cheyne and Burghard, while accepting its value and admitting the obscurity of its *modus operandi*, "can only suppose that the irritant acts in some way through the nervous system."² We have now to learn whether this value cannot be secured more precisely and in fuller measure through our better knowledge of the reflex relations of surface and deeper parts.

The use of local blood-lettings as by cuppings, scarifications, leeches, belongs probably to the same category of reflex influences. Mr. Marcus Beck used to insist upon the value of such treatment, and at the same time upon the obscurity of the mode of action. He would point out its marked efficacy in acute inflammation of the middle ear, though the blood happened to be drawn from the cutaneous vessels over the mastoid process, and not from the congested area itself; and again he would instance the relief obtained in acute orchitis by puncturing

¹ Erichsen's "Surgery," 9th ed., edited by Marcus Beck, vol. i. p. 222.

² "Manual of Surgical Treatment," vol. i. p. 17, 1899.

the distended scrotal veins, though these "have no direct communication with the swollen gland." In these cases his suggestion was that the effect might be "perhaps due to a reflex contraction of the arteries leading to the inflamed part."¹

To the question then, *Where* shall we apply the remedy? the answer comes, To the system at large or to the part or to both, and if to the part, then directly, and also indirectly through the vascular and nervous connections of that part.

When shall the remedy be applied? This is less evident, and we are still very ignorant in the matter, though the subject has not escaped attention in the past, witness Boerhaave's dictum: "I know of no remedy which does not owe its efficacy to its timely use."²

It is of course self-evident that, when a poison has gained access to the body and we possess an antidote, chemical or physiological, which we can bring to bear upon this poison, we cannot be too prompt in the application of the antidote. The everyday practice of the toxicologist is upon these lines, and clearly the same procedure must hold, whether the poison be amongst those which the toxicologist claims for his department, or whether

¹ Erichsen's "Surgery," *op. cit.*, vol. i. p. 208; see also Cheyne and Burghard, *op. cit.*, vol. i. p. 5.

² Paris, "Pharmacologia," 8th ed., p. 216, "Nullum ego cognosco remedium nisi quod tempestivo usu fiat tale."

be the product of disease and belong rather to the physician,—all that we demand is a reliable antidote. Accordingly the pharmacologist, having established his antitoxin, insists rightly upon its employment without delay, claiming for such “timely use” both the neutralisation of the poison already elaborated, and the possible inhibition of further elaboration by the microbes.

The older physicians required of the prescription that it should operate “cito tuto ac jucunde.” We must mend the formula, and in reply to the question, *When* shall the antidote be administered? answer, *Citissime, citissime*,—at the earliest possible moment. It is thus that in a case of diphtheria we shall inject the antitoxin as soon as the diagnosis has been established, or, if the clinical features are sufficiently distinct, without even waiting for the results of the culture.

In those diseases which depend upon a microbe, and develop their symptoms by means of a toxin, the microbe is less to be feared on its own account than by reason of that which it has in its pocket, and so long as we treat effectively the latter, we may be inclined to look with comparative indifference upon the former. Still, the toxin is only a product, which, elaborated in this or that quantity, possesses no powers of increase; it is opposed by the antitoxin, dose for dose, just in the same way as a given acidity is neutralised by a given alkalinity, and to confine our attention to the product, to the

exclusion of the germ which generates, is akin to the permitting of serpents to breed, on condition that their poison glands be destroyed.

If we can do no more than this we must be content with the achievement, but if possible we must reach further back ; it is necessary, therefore, to look to the germ itself, and if feasible make our attack here.

Some diseases of the type under discussion, viz., the infective, have so strong an individuality, such well-marked features, so definite a course, that we are tempted to think that our efforts can be palliative only ; that the ball once set a-rolling will complete its course, do what we may, that all endeavours to shorten it will be futile, and all attempts at suppression wholly out of the question : such are scarlet fever, typhoid, measles. But are we justified in this attitude of mind, or do we see anywhere in nature a life-history, be it higher or lower in the scale, which pursues its course independently of its surroundings ? The thing is inconceivable, and consequently we must conclude that, however unsuccessful our endeavours at modification or control may have been hitherto, the search must be persevered in : it is not a philosopher's stone we are in quest of, but a reasonable expectation.

Every living thing with which we are acquainted has its being in stages,—its life-history is a cycle. It begins by slow degrees, and, gathering momentum, attains a maximum ; for a variable period it main-

tains its fastigium ; upon this, a gradual subsidence occurs, terminating in a complete cessation, and the cycle is fulfilled. This movement is variably impressionable : at the outset, being weak, it is at the mercy of small opposing forces ; during the period of culmination it is least controllable ; in the third stage, as its momentum decreases, small forces will again acquire importance, and an increasing power to modify or suppress. Accordingly, when dealing with a morbid movement of this kind, the therapeutic points of vantage will be at the outset, and during the decline, for whilst the disease is at its height, not only shall we have to expend more energy in coping with the trouble,—a bad economy,—but the very attempt to stay the morbid momentum may endanger the integrity of the tissues themselves, just as the sudden arrest of a bullet in mid-flight may be at the cost of its disintegration. During the stage of decline, however, disease has already done its worst, and the fruits of therapy at their best must be relatively insignificant : in the first stage, therefore, our hopes for success in treatment will lie,—there will be our opportunity in *time*, and the answer to the question, When shall the remedy be applied ? will again be, *Citissime, citissime*.¹

¹ Witness the striking instance of the modification or suppression of the action of the poison of smallpox by the introduction of the vaccine of cowpox, the proviso being that the latter shall be introduced early in the incubation of the variolous infection, say, not later than the third day after the reception of the latter. Any time before this it is of course

During the prevalence of an epidemic it is common to observe short-lived febrile attacks which do not develop characteristically in any one direction. These attacks arise and pass away undiagnosed ; such are the febriculæ, and by many they are regarded as abortive seizures of the prevailing infection. If this be their true interpretation, then we have the demonstration before us that circumstances do modify in duration and in character the life-history of the germs of infection.¹ Shall we exclude medicinal agencies from the list of such controlling conditions? This would be unreasonable, and in presence of the influence of quinine upon the malarial germs it becomes a wholly untenable position. We are justified, therefore, in searching in the *Materia Medica* for the means of modifying, curtailing, suppressing the infective seizure ; having found the antigerm, and knowing the stage in which the germ is most vulnerable, we shall know when best to strike.

But the germ, though claiming an ever wider field as its own, is only one among the causes of

effective, but this means a still earlier action of the counter-acting vaccine, which either as such, or in its effects, will be in readiness within the tissues.

¹ To this evidence we may add that of the apparent complete insusceptibility of certain individuals to infection, however prolonged and intense the exposure ; we must suppose that in these cases the poison is received, but that the somatic conditions are so unfavourable as to wholly suppress it.

disease. Morbid actions there are, *e.g.*, the epileptic seizure, the uræmic convulsion, in which, though we must assume a poison, we have no valid reason at present to suspect a germ origin to that poison. These morbid actions, if we confine our attention to the muscular disturbance, also present stages. The fiat goes forth, a period of latency succeeds, in which certain hidden changes are taking place ; the storm then bursts forth, persists for a while in full strength, and then subsides, intervals of quiet breaking in upon the excitement. In its sequences the attack is not unlike the muscular contraction, as it may be witnessed in the physiological laboratory, in which the stimulus, the latent period, the muscular spasm, the relaxation, appear to follow each other inevitably. The question lies precisely there : is there no escape from this sequence once it has been entered upon, or may we expect to step in even here and modify, shorten, or suppress?

In certain experiments upon the insusceptibility of the ventricle of the frog's heart to a second stimulus thrown in during the stage of active contraction,—Marey's *refractory phase*,—it did appear as though the second stimulus, falling in during the period of latency, might, *under certain circumstances*, inhibit the first stimulus altogether ; so that the response to the two stimuli, each of which was by itself effective, was negative, no contraction whatever occurring. The *certain circumstances* were the presence of a potassium salt in given strength in

the fluid circulating through the ventricle, and the repetition of the faradisation at short intervals.¹



If we represent by the curve A B C D, the stimulation at A, the latency until B, the active contraction between B and C, the relaxation from C to D, then under the above conditions a stimulus falling in somewhere between A and B may suppress the contraction indicated by B C D. If these results should hold (they were obtained incidentally in the investigations of the before-mentioned paper) then our question is answered affirmatively for the muscular contraction, since it may be suppressed, though the call for it has been already made.

¹ "On the influence of certain drugs on the period of diminished excitability" (S. Ringer and H. Sainsbury, *Journal of Physiology*, vol. iv. pp. 358, 359). More recently, with the kind help of Professor Starling, I have made experiments with a somewhat different method of stimulation, in order to repeat and confirm the results above given. I have not been able to effect a suppression, either by two break shocks thrown into the ventricle during the period of latency, or by faradising the heart. The discrepancy I am unable to explain, but knowing the care with which the older experiments were made, the results must stand until they are negatived or explained away by a more complete investigation than I have been able to make.

Given the results with the single contraction, it would be a natural step to the contraction of a group of muscles and thence to the general convulsion; why should not these be modifiable or capable of suppression? Upon the strength of the experiments mentioned, however, we should not be justified in proceeding thus far; the subject calls for reinvestigation, and we must therefore seek for other evidence in respect of the local or the general spasm.

On the clinical side we obtain this evidence in the symptomatology of epilepsy, in which we find that certain warnings, *auræ*, precede the attack at times. These *auræ* mark probably the onset of a molecular disturbance which is to end in the muscular spasm. They indicate that a discharge, vibration—call it what you will—has begun, and the period which intervenes between the onset of the aura and the onset of the convulsion, may be likened to the latent period which intervenes between the excitation of the muscle and its contraction. That there must be some stimulus which precedes the aura cannot be doubted, and of such we have an example in the “excitants of attacks” which, though rarely observed in epilepsy proper, are yet established as exciting causes. In the experimentally induced disease in animals (guinea-pigs) these excitants may take effect in definite skin areas, the epileptogenic zones of Brown Séquard.¹ The entire process of the epileptic

¹ Gowers, “Disease of Nervous System,” 1888, p. 687.

seizure may thus reproduce the steps witnessed in the excitation and contraction of the single muscle. Now clinically it has been established that a stimulus thrown at an early stage into this sequence may suppress its subsequent stages, and it is thus that a powerful sensory impression, such as will be produced by the inhalation of ammonia, the swallowing of a mouthful of common salt, the inhalation of nitrite of amyl, the forcible application of a ligature to a limb above the seat of the spasm or sensation, may arrest a fit, which is not merely impending but actually on the move.¹ It is therefore possible to abort a pathological manifestation so well defined as the attack of the *grand mal*.

The arrest of the act of sneezing, an act violently spasmodic in some individuals, may often be inhibited by a strong sensory impression, as by firm pressure upwards at the junction of the upper lip with the septum nasi, or at another point, viz., where the cartilaginous and osseous portions of the nose meet; probably also by impressions made at other points, for the act is singularly easy of interruption, and may even be checked by focussing strongly the attention of the subject upon the act, and defying sternutation. In like manner it is familiar knowledge that in disease in the sensory area, *e.g.*, the attack of megrim, the nerve storm may often be aborted or cut short by remedies applied in the earliest stages of the attack; then it is that our

¹ Gowers, *op. cit.*, p. 687.

phenacetins and antipyrins and their congeners prove most efficacious. The occasional effect of a full dose of alcohol, of valerian, or of sulphuric ether, in arresting an attack of neuralgia (especially in the area of the fifth nerve) we interpret in the same way : the dose should be administered at the onset of the pain.¹

Without doubt many other similar instances might be adduced, but these may serve, and for the third time the injunction is repeated that the disturbance must be taken in its very beginnings if the treatment is to have the fullest opportunity.

With so complicated a mechanism as that of the human body, it is very hazardous to suggest a *modus operandi*, seeing that in a thousand and one ways interruption may be effected ; it is, however, important that we should not fail to include amongst these modes of working, one with which we are very familiar in the physical world, and which must operate with no less authority within the body itself. I refer to the phenomenon of *interference*. This tells us of the conflict between vibrations, and how by the coincidence at one and the same point of two waves in opposite phase, the vibrations will antagonise each other. If the two waves happen to be of the same vibratory amplitude they will completely annul each other, and in this way movement may beget rest ; light, darkness ; and

¹ Gowers, *op. cit.*, p. 765.

sound, silence. Short of such complete negation, we shall witness interference more or less complete, since the compounding of the waves is by algebraic summation. Now the statement is, not that this mode of action *may* take place within the body, but that it *must* take place there, unless the laws of physics are abrogated within the vital area—the hazard of the suggestion comes in only in the interpretation in this way of the particular manifestations to which we have drawn attention.

PART II

Positive treatment by reinforcement or concurrence.

The aspect under which we have been considering disease has been that of a conflict between the vital powers of the tissues and certain hostile forces which have gained an entrance to the body. Against these hostile forces the momentum of the *Materia Medica* has been directed, in the hope that the system would right itself once the elements of disturbance should be overcome. At times, however, not only are we unable to cope with the disorder, whether through lack of knowledge of an effective remedy, or because the antidote proves to be as inimical to the tissues themselves as to the disturbing elements, but we discover that in a certain proportion of the cases the removal of the active causes of disease is not followed by recovery,

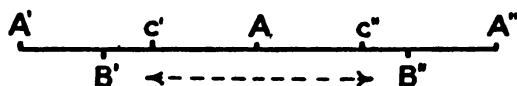
—so feeble is the healthward set of the system. In either case we must have recourse to other means, and these will be found to consist in the aiding and abetting of the tissues in their struggle against odds.

Now every circumstance and every thing which experience has shown to be favourable to the living principle will belong here, — climatic influence, hygiene, diet, the use of stimulants, tonics, alteratives, and all those means for developing the potentiality of the cell with which we are acquainted; but at this stage it must suffice to draw attention to one particular form of reinforcement, which is demonstrable only when a vital process presents a distinct periodicity. The forces of the body ebb and flow; this is true probably of all the bodily functions, but it is prominent only in the case of certain of these. As instances of a general periodicity we may mention the alternations of sleeping and of waking, and the diurnal rise and fall of the temperature of the body; whilst of special periodicities we have examples in the digestive cycles and the menstrual functions. Some periodicities may be acquired by habit in the lifetime of the individual, some are innate, but whether superficially or deeply organised, they all manifest the characteristics of the undulation, a rise and a fall, a turning and a returning. Here obviously is a case for opportunity, since a force incident at different phases of the movement must produce very different effects. Let us suppose that we

represent by the swing of a pendulum such a natural oscillation, the amplitude of the swing about the centre of rest being the measure of the health of the function ; let us suppose further that the movement is too feeble and that the function is threatening to come to a standstill.

In such a scheme let A be the centre of rest, A'A'' the swing of health, B'B'' the swing of disease, C'C'' two points equidistant from A.

It will be clear that in the to-and-fro movement



between B' and B'', any force, to be auxiliary, must always be in the same sense as the movement of the pendulum at the time of incidence, otherwise it can only impede.

It will be clear also that in respect of the centre of rest A, forces *opposite in quality, i.e.,* direction, may bring about the same result, whether of concurrence or of interference, provided that they are timed so to act. Thus if forces of equal magnitude but opposite direction be applied at the points C' and C'', *equidistant* from A, exactly the same effect will be produced in promoting or in opposing the swing, so long as the movement at these points at the time of application is either towards A or from A respectively.

May it be that the paradoxical results witnessed

now and again in medicine, according to which drugs seemingly opposite in qualities are employed successfully to correct the same disorder, will find their explanation in the relative time-incidences of the remedies in question? Be this as it may, there is no escape from the conclusion that the timing of the remedy becomes of essential importance, whenever we are dealing with functions characterised by periodicity, and the practical physician will be he who watches for the indications of the set of the movement, and brings in his reinforcement on the advance of the physiological wave. In this way he will administer the soporific towards the hour of sleep, when the organism is naturally tending sleepwards; the emmenagogue shortly before the expected period; the digestive stimulant before the meal. In this way the administration of the laxative will take account of the intestinal habit established by custom, and precede the natural intestinal movement by a longer or shorter interval, according to the rate of action of the drug.

Whither Nature turns her steps, in that direction it becomes us to lead,—“quo natura vergit, eo ducere oportet”; this precept of Hippocrates finds its application here and sums up in a few words the doctrine of reinforcement. In this way the *secundo prodesse* will seek, now by interference to antagonise the forces hostile to life, now by concurrence to promote those which make for health.

CHAPTER VI

THE COMBINING OF REMEDIES: THERAPEUTIC COM- PLEXITY—REINFORCEMENT—ANTAGONISM

“Concourir pour secourir.”

WHEN, after the siege of Troy, Ulysses set the beaks of his ships homewards to Ithaca, we know that he had before him a voyage as devious, as tortuous as the workings of his own crafty mind. To follow these wanderings, to measure and mark, were a task of no little magnitude for the student who, curious of detail, should attempt it. And yet, if we attend only to the effective steps in these journeyings, without regard to all those doings and undoings which advanced not at all the traveller's return, how simple the problem. A vertical of longitude through Troy as the starting-point, a transverse of latitude starting from Ithaca, the goal, these give us in their intersection our ordinate and abscissa, of starting-point and goal respectively; and in these we read directly the exact degree of southing and of westering necessary to

compass Ulysses' objective. All other journeyings profited not at all, though the Pillars of Hercules had been reached, or beyond, before the rocky island gave the anchorage.

After this fashion, the physicist, by the *method of projection*, brings out the real significance of any course, however labyrinthine, the only data required being the position of the points which mark the beginning and ending of the course.

Some such method as this is needed by the pharmacologist, when we picture to ourselves the complexity of the task which faces him, if he prepares to follow and resolve the action of a given substance as it travels through the system. At every point in its journey its incidence must be felt ; these contacts will follow each other in time, they will differ in degree and in kind, as the reacting tissues, which feel the impacts, themselves differ in build and quality. To assume that this sequence of effects and this variety of actions will all be in one sense, in one direction, is to assume the improbable, not to say the impossible. Without reasonable doubt the sum total of effects will include a mass of conflicting elements ; influence here being opposed by action there ; and upon algebraic summation there will emerge a resultant as incommensurate with the aggregate of actions, as the crow-flight from Troy to Ithaca, when compared with the ten years of wandering of the son of Laertes.

To take a concrete case : foxglove, by its influence

upon the circulatory system, and by the preponderance of this action upon the left ventricle of the heart and the systemic branchings of the arterial tree, raises the muscular tone of both, and causes a general rise in blood-pressure. But the contraction of the arterioles, which is a prime factor in this rise, will vary in the different vascular areas, by reason of the difference in their innervation and in the muscularity of their vessel walls. As a result we shall have the vessels here more open, there more contracted, and the blood, escaping under pressure along the lines of least resistance, will flow here in fuller, there in thinner stream. We may even witness what appears to be an anomaly, viz., that whilst in general the arterioles will show us contraction, more or less, a certain set of branchings may actually dilate under the influence of the drug. Accepting the phenomenon, we have no reason to think that its explanation is to be sought in a selective and special action upon a particular vascular area; we have no reason, indeed, to think that in this area of increased vascularity the vessels do not receive, and respond to, the same stimulus under which the arterioles generally are contracting. The reason for the difference in effect is to be sought rather in the poor development of the vaso-motor control in the area in question, which makes it impossible for its vessels to withstand the more powerful constriction which is taking place elsewhere; accordingly, the last named must prevail, and the vessels

of weak contractile power will dilate *passively* under the rising blood-pressure. The cerebral arteries are such vessels of relatively weak innervation, and it is quite possible that they may behave as above stated under the influence of digitalis.¹

The rate of flow of a liquid through a system of tubes being directly as the pressure, but inversely as the resistance, this behaviour of the vessels of the brain will mean a *luxus* supply of blood to that organ. At the same time it is quite possible that an improved flow will be taking place through the capillaries of the system generally, the raised arterial pressure more than compensating for the general narrowing of the arterioles. This will not mean necessarily more blood in the parts supplied—indeed, there may be less—but it will mean more current and less stagnation. The change, in fact, will be one of distribution, more blood being now on the arterial side, less on the venous side, and a quicker flow across the capillaries.

But there is reason to believe that on occasion constriction may so raise the resistance locally, as to seriously diminish the flow in a particular district. The renal vessels are instances of this, and with larger doses of digitalis we do, at times, witness such narrowing of the arteries that the kidney is practically starved, and the secretion of urine temporarily suppressed. This effect must be regarded as the

¹ Bradford's article in Hale White's "Pharmacology and Therapeutics," p. 121.

result of toxic doses, but it may none the less be cited as exemplifying the diversity in action of a given agent, and how, under the impress of one and the same medicament, a single system may react so as to present here an organ flushed, there an organ starved, and, between these extremes, all degrees of blood supply. Other things being equal, blood supply will measure functional activity, and therefore this scale of circulatory activity will represent a corresponding scale of activity in the tissues and organs severally.

What will be the resultant effect upon the circulation through the tissues of the body as a whole? A positive one doubtless, when the remedy is administered in a suitable case of heart failure, but we stand greatly in need of the *method of projection* when we desire to go further, and arrive at a quantitative estimate of the net gain to the economy.

If, in a comparatively simple case like this, we need the method, how much more do we require it when we attempt to estimate quantitatively the effects of a medicine such as physostigmine. The pharmacology of this drug is very complex: its incidence is a marked one upon the central nervous system; the respiration and the circulation, directly or indirectly, are affected; the skeletal muscles and the unstriated muscular fibres generally are strongly acted upon; also several important secretions; lastly there is a specific action upon the internal mechanism of the eye. The therapeutic outcome of all this is

disappointingly small, and wholly disproportionate to the manifestations which the drug develops in detail ; so disproportionate that we are tempted to inquire whether this is due to our inability to make proper use of the virtues of the drug, or to the fact that the energies developed are at such cross-purposes that in the end little remains over for therapeutic utilisation. In any case the need for a method of quantitative summation is most clear, and it is the lack of this which makes so bewildering the attempt to piece together the findings of the pharmacologist, and bring them into line with the experience of the therapist. Above all is it necessary to use caution in deducing from these same findings, when they have been obtained from experiment upon isolated organs.

In the absence of any method for determining quantitatively the resultant action of a drug, how are we to proceed ? We must content ourselves with qualitative methods, and with the recognition that the influence which we are employing is on the hither side of that line which separates therapeutic action from toxic action. The chemist in his testings is wont to make use of some reagent, which is very sensitive to that particular condition which he desires to maintain during his experiment ; and it is thus that, by litmus or other colour indicator, he determines a required alkalinity or acidity, and is able with precision to maintain the one or other state.

Borrowing from his methods, we shall seek to discover which of the organs or tissues is most sensitive to the influence of a given remedy, and can earliest inform us, by the nature of its response, whether the remedy is acting favourably or unfavourably upon it. Such organ will give us the danger signal, and it will be possible to act upon this signal, and to reduce or stay administration upon its appearance. This method might be called the *indicator* method, and actually it is largely employed in medicine, both consciously and unconsciously, but scarcely as consciously, as systematically, and as critically as it should be. In another way it is possible to make use of the indicator method, but this time it is not the more sensitive, but the more refractory organ, which we shall select. When we employ this variant the organ chosen is of more vital importance, and we are content to ignore more or less the action upon other less vital parts. Upon this latter method the anæsthetist relies, and by its means he suppresses fearlessly function after function until life is reduced to a "little flesh and breath," the "ruling part" having long since taken its departure.¹ Here the response of the centres in the vital knot absorbs wholly the administrator's attention; all else he ignores.

Upon the former method many physicians, using the renal system as an indicator, control the adminis-

¹ "Thoughts of the Emperor Marcus Aurelius," by George Long, Bohn's ed., p. 78.

tration of digitalis, the dose of which they maintain or push, so long as there continues a free secretion of urine. In like manner the action of arsenic is controlled by the symptoms of irritation which are prone to appear in the alimentary tract, conjunctiva and skin, all of which are sensitive to the medicine. Upon this plan also it was customary to administer mercury, in the days when this metal was employed in more heroic fashion than now prevails ; the dose of the mercury being advanced until a specified degree of stomatitis was induced, as measured by the quantity of saliva collected.

That the indicator method should be used consciously and systematically is clear, but it is no less clear that it must be used with great discrimination, since all organs do not speak with the same authority in the council of the members. Thus it would be folly to place upon the same footing a dyspnœa or syncope on the one hand, and a conjunctival irritation or a pigmentation of the skin upon the other ; and we may judiciously overlook a pronounced symptom in an organ of secondary importance, in favour of a less obtrusive symptom occurring in an organ of the first rank. Dr. Murray of Newcastle counsels wisely, therefore, when he advises that an epileptic, refractory to the more usual methods of treatment, should run the risk of an argyria, provided that the nervous symptoms bid fair to yield to a course of silver nitrate,—to exchange a clouding of the mind

for a darkening of the skin is surely profitable barter.

Without pursuing this matter further it is necessary to add that the indicator, which has proved reliable in the rule, may not prove so in the particular, and that whilst average results must always initiate our therapeutic measures, these will ever have to be controlled or modified by close observation of the individual; also that as a general rule it is not safe, except perhaps in crises, to concentrate attention upon the functions of a single organ, to the exclusion of those more general aspects of the body which must always be paramount.

These preliminary considerations bring us to the subject proper of this chapter,—the combination of remedies. We touch here a vexed question and a much abused art, but it has its roots deeply set in the past, and its claims upon our attention cannot be ignored. Not a few hard names have been bestowed upon the art of combination, and to the man of science the word polypharmacy is an abomination. To him and to his followers the subject is antiquated, if not obsolete; admittedly in place in the days of the abracadabra, the incantation, and the exorcism; not to be wondered at whilst astrology held men's minds, and the search for the philosopher's stone, and the doctrine of signatures, but not to be tolerated from that time when Lavoisier instilled a new spirit into

science, and the theory of phlogiston gave way to simpler conceptions. Yet in broad daylight, in the glare of modern science and of modern criticism, the practice of combining remedies still flourishes. A survival such as this points to a powerful vitality, and it becomes a matter of great interest to inquire how this seeming anomaly comes to be, and how it is that men of enlightenment and of scientific training, fully conscious of the complexity of their subject, have the audacity to multiply this complexity still further, by their practice of a polypharmacy. On the face of it, it is against reason; why then do they persist? One answer, and one only, can satisfactorily meet the situation, viz., that experience has proved the value of the practice.

If this proving can be established the answer is final, and our explanations must adapt themselves as best they can to the ascertained fact. But whilst it is unquestionable that the combining of remedies must complicate the task of the investigator, are there any cogent reasons *per se* why combination should not mean co-operation, and why, therefore, when we get below the surface, a reasonableness should not become manifest which the face of things did not wear?

If we look into this matter, it will be borne in upon us that the art of combination with a view to co-operation is a principle which is widely applied outside the field of medicine. Thus if we pass from the pharmacy into the kitchen, we

recognise at once that the culinary art is essentially an art of combining, and of those who are prepared to deny this art in the laboratory, how many will there be who will not suffer it gladly in the kitchen? Should it be objected that the elaborate dish and the attractive menu is not so desirable as the simple homely fare, is not this objection on grounds other than those of culinary want of success; is it not rather a tribute to the very attractiveness and success of the cook's art, which tempts to an indulgence beyond measure, and in excess of the powers of digestion? Is there anything indeed to show that, *where moderation is observed*, the tasty dish is less digestible than the insipid one? Is it not just the opposite? But this appeal of the savoury meal, it is the appeal of a judicious commingling from the armamentarium of the chef. And this appeal is a direct one to certain nerves of sense, olfactory, gustatory, visual, which, by the appetite excited, and by the familiar flow of saliva which attends, give evidence of the response of the digestive organs to the call.

Now if savours and flavours may be so combined as to influence more powerfully certain nerves and nerve-centres, why shall the medicinal virtues of plants and minerals be incapable of similar co-operation? And if physiologically we can establish our proposition, is it not a foregone conclusion that it will be established pathologically also, since pathology is only physiology gone astray?

But, granting in theory the possibility of effective medicinal combination, it still remains to be proved that in practice it is feasible, except by some happy chance. To this it must be answered that since it is possible for the chef, why not for the physician, and that, allowing the important part which chance has played and may still play in the advance of the art of medicine, it is the part of the physician to observe and record those happy chances and to strive to imitate them.

But it will be said, Think of the chemistry of the multiple prescription, what interactions, what breakings up and recombining; who shall say what it is that is really administered when thus we admix! And the reply,—Think of the chemistry of the curry, and of the dinner in multiple course, each dish a triumph of the art of commingling and of blending; who shall care what it is that is really partaken of when thus it commends itself as a whole!

The objections, therefore, to the combining of the elements of the *Materia Medica* cannot be upheld either in theory or in practice, in view of the successful combining of the elements of the *materia diætetica*,—the appeal in either case being to the same court, to wit, the body corporate. True it is that medicines, which draw so largely from the crystalloids, will in general be of a more active nature than the foods, whose colloidal composition implies movements and affinities of comparative

sluggishness. But after all, these are differences in degree only, and they do not invalidate the argument that since the one is a physiological success, why not the other.

Examination into other departments of physiological activity teaches us similar facts in respect of the combining of forces, which as stimuli are brought to bear upon the body. Witness the effect which the full orchestra develops under the conductor who knows how to marshal and to combine, and consider what would be the result upon the auditory nerve, if the flood of sound, which, duly ordered and balanced, gives rise to pleasurable sensations only, could be transformed and concentrated within the narrow limits of the monotone: is it not a foregone conclusion that the nerve would not be able to bear the strain, and that pain, not pleasure, would result? Orpheus with his lute, if we are to believe the legend, touched the strings to some purpose, teaching the world the all-compelling power of music, yet even he, whilst demonstrating his mastery, could scarcely have told us how the thousand and one vibrations of his strings would cross, interfere, reinforce, and develop their vibrational resultant. Sufficient for this *maitre sonneur* that he possessed to perfection the art of combining sounds.

The fields of vision repeat the same story. Whatever pleasure the monochrome affords, and

it is not small, provided that a master hand delineates, it yields to the higher delight of colour in its numberless hues, provided always that the master hand depicts. The optic nerve and visual centres confess the power of the colour harmonies on the canvas, and the mind also acknowledges their authority, though it admits its incapacity to comprehend their science. But shall we take the brush from the hand of a Gian Bellini because he cannot sum up for us, in terms of the composition of forces, the jostlings of the vibrations which converge from his canvas upon the eye of the beholder? That the result will be a sensory harmony when these vibrations shall have reached the brain, this he can tell you, but no more, neither is it required of him.

Why then do we expect of the physician that which we do not demand of the musician or of the painter? Is it because of his arrogance in claiming to possess a science rather than an art? Perhaps so, and upon this ground we may have to admit that he is not undeservedly punished, for though medicine is a science *in spe*, it is still an art *in esse*. Healing, as it is practised, is an art, with a tradition; it remains, and long will continue to be, the *ars medendi* of the ancients. It looks towards science, it borrows scientific methods and scientific terms, as aids to investigation and classification; it hopes for science: in its application of results, however, it is essentially an art.

Upon this understanding, and provided that this be his plea, shall not the physician be allowed to write his prescription in peace?

We must commend another aspect of this question to the purist in prescribing. The same, whilst limiting himself scrupulously to the use of one drug at a time, will seldom hesitate to prescribe the crude drugs,—opium, digitalis, bark, ergot, senna and the like, entirely oblivious of the fact that in so doing he is guilty of the most flagrant polypharmacy. Let him be at the trouble to count up the active principles in these remedies, and let him note that opium, that juice of all others, without which, as an old writer has said, “Medicine would be lame and halt”¹—that this corner-stone of the healing art numbers in its composition some nineteen alkaloids besides other ingredients. True, several of these alkaloids are present in traces only, but, making every allowance for this, opium remains a striking instance of the multiple compounding of Nature herself. The purist will also note the very remarkable fact that in opium, as in some other medicines of primary importance, we find that certain of the contained active principles are strongly antagonistic the one to the other; so that not only does Nature combine her forces, but her combinations, after the manner of algebraic equations,

¹ “Sine papaveribus, et sine medicamentis ex eis confectis, manca et clauda esset medicina.”

include plus and minus quantities. Thus in opium we meet with the sedative morphine, and the convulsant thebaine; in calabar bean, with the depressant physostigmine and the strychnine-like calabarine; in gelsemium sempervirens with the coniine-like body gelseminine, and gelsemine, a tetaniser. In these combinations we can scarcely be said to have co-operation; and the precise meaning of the apparent conflict is hidden from us. There it is, however, and by Nature's own doing, the admixture of bodies which contend more or less for the mastery. We shall not commit the error of seeing in these oppositions the exact equivalent of the plus and minus of the equation: they are not absolute negations, each of the other—they differ qualitatively and their incidence is probably in many cases upon different parts of the system; all that we can say is that in the main the results appear to be antagonistic.

Pending the interpretation of this phenomenon, we shall note its counterpart in the observation, so familiar of late, of the co-existence of the toxin and antitoxin in animal tissues. In this case, apparently, the one precedes and engenders the other, the toxin calling forth the antitoxin. May it be that this relationship is not *sui generis* but an example only of that ground-law of *action* and *reaction* which Newton formulated for us long ago, viz., "that action and reaction are equal, and act in opposite

directions.”¹ From this point of view the antitoxin might be regarded as the physiological rebound of the incident toxin, a result as it were of the tissues’ protest, an act of self-defence on their part.

Do we glimpse here a protective mechanism and in another form an instance of stability or balance?

When an elastic ball impinges upon a resisting surface, the resistance encountered so modifies the incident momentum that this latter is deflected from its former course. The ball leaves the surface in a direction more or less opposed to its former path. If it strike the surface at right angles it is turned directly back, and if the ball and the reacting surface be perfectly elastic the reversal of the momentum is complete; in quantity it is unchanged, in sign it is reversed. The momentum of incidence will recoil from the surface as a momentum of reflection, which is in absolute opposition to the former. Any subsequent equal momentum pursuing the path of incidence described, and meeting with the return momentum of the first impact, will be completely annulled. If the ball do not strike at right angles, then the deflection will depend upon the angle of incidence, and as this angle is, so will be the degree of modification of the momentum, from the complete reversal mentioned

¹ “*Actioni contrariam semper et æqualem esse reactionem; sive corporum duorum actiones in se semper esse æquales et in partes contrarias dirigi.*”

above, to a change, so imperceptible that the course of the ball is not noticeably altered.

Similarly, if a toxin, *i.e.*, a something out of harmony with its surroundings, be introduced into the body, the activities of the toxin and of the body must clash, and a reaction of some sort must ensue ; that reaction will be of the nature of an opposition to the poison, an antitoxin, the very meaning of the word reaction implying this. It does not signify whether the action in question be a physical momentum or a chemical activity, as little as it signifies whether the mass conveying the activity be molar or molecular. The toxin which makes its impact and then disappears, is as much the parent of the antitoxin which emerges after the impact, as the impinging elastic ball is the parent of the elastic recoil.

Further in the same way that, *cæt. par.*, the elastic recoil varied with the angle of incidence of the ball, according, that is, as the line of flight of the ball *opposed* more or less the direction of the reacting surface, so the potency of the antitoxin will vary according as the activities of the toxin oppose more or less the activities of the tissues.

But what is true of animal tissues will surely be true of vegetable tissues also, at least in respect of fundamental properties and behaviours, and so it may well be that in point of time the vegetable toxin shall precede its antagonist and be its cause. This question might be investigated by examining

chemically into the relative proportions of antagonising constituents, at different stages of the growth of the plant, for, if the above hold, the tendency would be to the gradual increase of the antitoxin at the expense of the toxin. The older herbalists used to be very precise in their directions as to the time and season at which the various parts of plants should be culled in order to secure them in their most active state. The mystical teachings of the astrologers were no doubt responsible for some of these directions, which took note of the moon in its phases, and of the stars in their conjunctions,—“in such a night Medea gather’d the enchanted herbs that did renew old Æson”; but the life of a plant is a movement from beginning to end; it is a procession of events, and its chemistry must move with its changing form and activities, so that we can hardly conceive that time and season should be without their influence upon its composition, and therefore upon its potency. Thus, if upon investigation these considerations should be upheld, we might acquire some insight into the reason of these changes by the law of action and reaction.

Leaving the question of the mode of origin of the anti-principles in animal and vegetable tissues, and regarding simply the fact of their existence, it is clear that the main action of remedies thus composite will be due to the preponderance of one or other ingredient or group of ingredients; and it may seem

that we should do better to work with the individual constituents separately. But we would again urge that the counter elements are not direct negatives, that they oppose only more or less, and we may add that it is possible that this partial opposition has a value of its own, just as we see in the use of the muscles of the body, say in the flexion of a limb, an accompanying though weaker action of the opposing extensor muscles. In this partial antagonism we recognise a physiological gain in the steadiness and control of the movement.

Hesitations such as these will not arise where, in the compoundings of Nature, we fail to recognise the presence of elements which seem to cross each other; in these we shall admit that the principle of co-operation pure and simple may reasonably apply.

Another example of Nature's own combining must not be overlooked; we refer to those natural waters, the efficacy of which is admitted the world over, and attested by the evidence of centuries. If in these we look merely at the basic and acid elements or groupings, we become aware of a notable poly-pharmacy: chlorides, bromides, iodides sulphates, phosphates, carbonates upon the one hand; sodium, potassium, lithium, magnesium, calcium, barium, iron, manganese, and so forth, upon the other. The list is incomplete, but sufficient for the purpose, and though it is not suggested that all the above named are present in any one water, or denied that

the proportions of these ingredients vary from quantities appreciable to mere traces, yet reference to any table of analysis will make clear the multiplicity of the pharmacy. Neither can we afford to lose sight of the important part which minimal quantities play in physiological processes, a fact to which Ringer's experiments, with lime salts in particular, draw attention. These raise the potentialities of the traces before mentioned to a high level, and accentuate the polypharmacy of the mineral waters.

Now are these waters efficacious or not? The choice is before us. Either we must be prepared to sweep into the limbo of the obsolete and outworn these time-honoured springs with their presiding deities, nymphs and naiads, and explain as best we may their present world-wide use, or we must allow their efficacy, their claim to pomp and circumstance, and admit the success of combination.

Is the complexity of these combinations a necessary one; might simpler formulæ work as efficaciously? These are questions easy to put, but very difficult to answer, and all we can say in reply is that the prescription is effective, that it is Nature's handiwork, and that all science is based upon the study of Nature.

Be it well understood we are not pleading the cause of the Antidotum Mithridatum, which in the course of time seems to have developed into the Theriaca Andromachi, and is said to have then

numbered some seventy odd ingredients, including amongst these, vipers, amber, castor, opium, etc.;¹ nor of Gascoigne's powder (Pharm. Lond. 1652), with its prepared pearls, crab's eyes, red coral, pale amber, hartshorn, bezoar of the East, powder of the black tips of crab's claws, the whole made up with the jelly of the sloughs of British vipers; nor of any similar farragos, as Dr. Heberden well terms them.² We are contending only for such limited combinations as design or chance may have wrought, common sense approved, and experience sanctioned.

We would urge indeed that simplicity should ever be the starting-point, and from this no departure permitted except with a definite object in view, and upon a reasonable expectation, based upon observation or experiment.

Given this objective and this reasonable expectation, together with the example which Nature herself has set, we must conclude that it is permitted to combine, nay, that we are encouraged so to do.

¹ "Pharmacopœia Londinensis," A.D. 1682; see also Paris, "Pharmacologia," 8th ed., pp. 41, 42.

² Paris, *op. cit.* p. 42.

CHAPTER VII

THE PRESCRIPTION

Audi, . . . hanc normam, hanc regulam, hanc præscriptionem esse naturæ (Cic. Acad. II. 46).

THE sanction to combine having been accorded, the next step is to inquire into those principles which shall guide us in so doing.

To begin with it must be laid down as an absolute rule that combination is permissible only when we have a definite object in view. The right of each constituent to a place in the prescription must be challenged, and a valid claim established, or it must not be allowed. Indeed, if a single remedy will answer every purpose, for example, a few grains of calomel placed directly on the tongue, to what end shall we cast about for adjuvant, or corrective, or vehicle : the drug is complete in itself, and the prescription in its simplest form is before us.

At one time, before chemistry had probed so searchingly, it was held that each medicinal herb represented a single remedial activity, and for this

reason it was named a Simple. We now know how very far removed from the fact was this view, but none the less we may, with advantage, retain the term in its original sense, applying it, however, to the real units of the *Materia Medica*, whatever their source, physical or chemical, inorganic or organic. We shall then say : first take stock of your simples and see if these severally can develop the healing forces which are needed ; if they can, —go no further.

In the first place then, the prescription will invoke the aid of *Sancta Simplicitas*.

So plain a case as that of the dose of calomel just cited will, however, be the exception, and the first step in combination will arise from the necessity of conveying the remedy by some suitable medium, which is then styled the vehicle. The ideal vehicle will be a carrier only, it will neither bring qualities of its own, nor will it modify those of the active principle which it conveys ; indifference will be its special recommendation. From such vehicle the substance conveyed will be recoverable unaltered. Of this kind of prescription in fluid form we may cite as examples, solutions of the hydrochloride of strychnine in water, of cantharidin in olive oil, of menthol in liquid paraffin ; in solid form we may instance, a powder consisting of morphine and of dried starch in fine division, as carrier, or a pill mass, in which kaolin ointment is made to convey the unstable potassium permanganate—these

give us common varieties of the one-drug prescription. Admittedly, no carrier comes up to the ideal requirements, since it is never quite indifferent, but in the instances given, the action of the vehicles is so slight, so incommensurate with the potencies conveyed, that it may be passed over as a negligible quantity.

To Pharmacy we must look for instruction as to the choice of vehicles, which will vary according to the solubilities, volatilities, stabilities, and other qualities of the simples to be administered.

The next step in combination will be taken when we commingle in one dose, substances which interact chemically upon one another, as for instance, when we administer in the same vehicle mercuric chloride and potassium iodide; or when we prescribe the *mistura ferri composita* of the British Pharmacopœia, in which the ferrous sulphate and potassium carbonate react one upon the other. The modifications which result in such cases are very appreciable, but the point calling for special note is that they take place outside the body, and within the limits, so to speak, of the formula itself,—in readiness within the phial is the chemical resultant to which the play of forces has given birth.

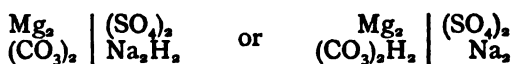
The same is true, when, by the dispenser's art, the chemical combinings are kept in abeyance until they are within the alimentary tract; as for instance in the case of the *Pilula Ferri* and certain variations upon this, which secure the separation of the in-

gredients of the prescription until they are set free within the stomach. When upon this a mixing takes place, the same resultant arises, but when this occurs it is still outside the tissues; we do record, however, an advantage by these devices, for the chemical resultant now takes effect in the *nascent state*.

To Chemistry we shall look for instruction as to the products which we may expect when thus we combine. She must teach us as to the composition of forces within the prescription, in how far the constituents will conflict, in how far they will work in unison, what new associations will be formed, and in what direction and in what magnitude the interactions will beat up a resultant whilst *in vitro*.

As an instance of the kind of teaching of which we writers of prescriptions stand so much in need, mention may be made of the interactions which take place between such salts as magnesium sulphate and sodium bicarbonate, and between bismuth salicylate and sodium bicarbonate. Recognising in magnesium sulphate a fully saturated combination, neutral in reaction if pure, and in the bicarbonate of sodium a salt which, though acid in structure, is yet so far dominant in its base that the salt gives a slight alkaline reaction,—we are surprised to find that, upon their mixing, a liberation of free carbonic acid ensues; the neutral sulphate of magnesium appearing in fact to play the same part as a dose of acid. If however one set down the formulæ of these

salts, and the new associations which, by double decomposition, should ensue, one perceives either that a molecule of free acid will be liberated which will then react upon the neutral magnesium carbonate formed, or that the bicarbonate and not the neutral carbonate of magnesium will be the outcome of the interaction; in this latter case the feeble basicity of the magnesium would have to explain the liberation of the carbonic acid which in part escapes from the hold of the relatively weaker base.



Similar considerations will apply to the effervescence produced by the interaction of bismuth salicylate and sodium bicarbonate, without the need of invoking the theory of the existence of free acid, adherent to the bismuth salt, in explanation of the manifestation.

To proceed with the main argument: the next step in combination is of another kind, it refers to the association in the same prescription of two or more simples, each of which, though chemically indifferent to the other, is possessed of biological activities of an appreciable magnitude. In this case there is no preformation of a resultant, the chemical interchanges are subordinate and may be ignored, and it is only after the entry of the component parts of the prescription into the system, and the impression of their powers upon the tissues, that the

potency of the combination declares itself. Within the body itself does the play of forces first make itself felt,—here begins and ends their composition into a resultant whose thrust is in this or that direction.

To Medicine proper and to Pharmacology we must go for the teaching here in demand, and to the consideration of the problem from this point of view we must proceed.

We have seen in the foregoing that remedial agents may assist either by antagonising morbid movements, or by reinforcing vital movements; at that time our attention was fixed upon the organism acted upon, rather than upon the remedy acting; we were looking at the way in which help might be acceptable to the tissues, rather than at the way by which the antagonism or the reinforcement might come: it is to this latter that we must now give our attention.

Under the heading of therapeutic complexity it has been suggested that the influence of a remedy upon the system may include many conflicting actions, and that the agent can make good its title as remedy, then only, when the issue of the conflicting actions is a positive gain to the body.

When we bring to bear such remedies as arsenic, iron, digitalis, mercury, opium, and the like, and witness their effects upon the system as a whole and in detail, we note that in some directions these effects are distinctly undesirable, and that to ensure

a therapeutic action we must keep the dosage within the limits of the production of these same. Indeed, in some susceptible people, so dominant are these detrimental by-effects, that they entirely disqualify the drug in question, which unto such is a poison, not a remedy ; whilst even for the average individual the by-effects may set irksome restrictions upon the employment of the remedy. Thus we find this patient unable to take arsenic because it irritates the stomach, that patient unable to continue the iron course by reason of its constipating effects, a third salivated by mercury on the least provocation, whilst a fourth develops a severe coryza or a troublesome skin eruption with quite small doses of iodide.

Accordingly, acting upon the theory that by the combination of remedies we can promote their effectiveness, our first aim will be to get rid of the conflicting elements in the action of a medicine, to cleanse it, as it were, of these impurities, to remove its disqualifications. Adopting, with this in view, the nomenclature of the ancients,¹ and characterising by the name *Basis* that main remedy whose fundamental action we wish to convey, then the first step in combining will consist in the addition of the *Corrigens* to the formula, and the prescription will stand :

1. Basis.
2. Corrigens.

¹ "Theory and Art of Prescribing," Paris, "Pharmacologia."

As examples of such combination we may cite : the use of mercury-with-chalk and Dover's powder, the opium in the latter tending to correct the laxative action of the mercury,—indeed in the preparation itself, mercury-with-chalk, the presence of the chalk probably serves a similar purpose ; the association of iron with aloes, in which preparation the aloes counteracts the constipating action of the iron ; the admixture of colocynth with henbane, of castor oil with laudanum, of aloes with myrrh, saffron, and the compound tincture of cardamoms, in each of which the object is to correct the griping effects of the purgative ; the administration of arsenic simultaneously with the bromides, though not necessarily in one dose, to check the irritative effects of the bromides upon the skin ; the addition of magnesia to the colchicum prescription for the purpose of lessening the irritant action of the latter. Not always have we the means of correcting an undesirable effect, and in that case we may have either to discard the drug or to reduce its dose ; it is thus that barium salts, which possess powerful digitalis-like qualities, have made so little advance as medicines, their irritant action upon the alimentary tract disqualifying them. Sometimes in the absence of a corrigens we may get over the difficulty by giving the medicine upon a full stomach, as is the practice when we administer arsenic, but there must be many medicines waiting to be enrolled on the list of remedies for want of a suitable corrigens.

By the aid of the corrigens the medicament having been presented in its most effective form, *i.e.*, shorn of its disabilities, the art of combination will now seek to advance by another way, that, namely, of reinforcement. This method assumes the possibility of co-operation by positive contribution, by a summation of effects, and the term *Adjuvans* names this form of assistance.

Help of this kind may be two-fold ; it may, for instance, be of the same nature qualitatively, and its incidence be upon the same parts, or it may differ both in nature and in site of incidence : the adjuvans may thus be homogeneous or heterogeneous. It may also be subordinate or co-ordinate, for whilst in the majority of cases we shall entrust to one remedy, the *basis*, the main therapeutic action,—the *adjuvans* being distinctly secondary,—there will be occasions when the actions of two or more co-operating influences are so nearly upon a level if homogeneous, or so difficult of comparison if heterogeneous, that we shall find it difficult or impossible to decide as to which predominates.

The formula of the prescription now stands :—

1. Basis,
2. Corrigens,
3. Adjuvans.

Empiricism must determine the value of the adjuvans in the combination of remedies, but it may be worth while again to put to ourselves the

question, What *a priori* arguments does Nature adduce to encourage us to the trial; do we follow her lead in so doing, or are we seeking at a venture?

We have already referred to Nature's own combinations, and since these furnish the *a priori* arguments in actual demand, it may seem superfluous to go further; yet it is desirable to look more closely into this subject in order to perceive the opportunities which Nature affords for multiplicity of action, and how, in her fundamental workings, she makes room for combined action.

Every gas is to every other gas as a vacuum,—this statement is known as Dalton's law,—and from it we learn that the molecules of a gas in possession of a given space do not prevent the molecules of another gas from permeating that same space; nor do the mixed molecules of the two gases prevent a third gas from diffusing itself into their midst. In other words, a given space allows room for the *simultaneous* presence of the molecules of an indefinite number of gases, room therefore for the dynamics of their particles.

Within the lungs, the gases of respiration inter-diffuse themselves according to this law, and by virtue of it we can bring to bear at the same moment the combined influence of two or more gases,—of this, advantage is taken in the administration of anæsthetics by inhalation.

The impregnation of an atmosphere by the evaporation of a solid, such as iodine, and of a liquid, such as bromine, takes place similarly ; making allowance for the differences, dependent upon pressure and the temperature of fusing and boiling points, which distinguish a vapour from a gas. Aerial disinfection is worked by such impregnations of the atmosphere with gases or vapours.

Combinations of this kind in which the individual elements maintain their identities imply of course that they do not interact chemically, the one upon the other.

A liquid which has saturated itself with one salt so that it can hold no more of it, is yet able to dissolve freely other salts presented to it, and by the laws of diffusion these salts will permeate the liquid completely, so that in every unit of volume we shall discover the joint potencies of the several salts in solution. The fluids of the body therefore, according to their solvent powers, will be available as carriers of multiple influences, not merely in succession, but in concourse.

Substances in the colloidal state, that is, in a viscous or gelatinous condition, behave very much as liquids, and it is a matter of surprise to learn how permeable this state is to the quick movements of crystalloids ; these latter diffusing themselves through the jelly-like mass, according to the same

law as obtains for liquids. But protoplasm, in all its varieties of form and activity, is in this colloidal state, and we realise hence how fair is the field which it offers to the competitive influences of all comers.

A rod, a taut string, a column of air, are each capable of vibrating, not at one rate only, but at many rates, and these not in sequence, but simultaneously, tones and over-tones concurring. More complex still are the vibratory powers of a stretched membrane. In the special organs of voice and of hearing, the laws of tensions and vibrations are strikingly illustrated, and it is certain that outside these special areas the same laws are exemplified, since strains and stresses, implying tensions and vibrational possibilities, prevail throughout the body. Whenever and wherever, therefore, vibrations shall seek admission into the body as curative forces, we must remember how open is the door unto them, and that we are not taking advantage of the situation if we restrict ourselves to the presentation of oscillations in single file. Why then intone when the compass of the voice is at command and the choir awaits direction? Was it not upon the many-stringed harp that David played when he dispelled the madness of Saul?

Here is scope for the adjuvans; combine we may, Nature points the way with numberless

examples ; combine we should, for she has expressly made room for such combination. Moreover, there is a reasonableness in combination at which we have already hinted, and which rests upon that which we may term the law of fatigue. If we consider for a moment, there must be limitations to the admission of vibrations, whether we are dealing with the inorganic or the organic world : the breaking strain, the fusing point, the point of ebullition—these are instances of such limitations, and of the giving way of structure or form under the intensity of the vibration. Much narrower limitations bound the oscillatory powers of the organised tissues. Increase the intensity of the vibration beyond a certain point, and pleasure gives way to pain ; continue the increase and the structure breaks down, and all carrying power is lost with the death of the tissue. But short of death, short of pain, vibrations long continued, especially if relatively forcible, produce in the structures of the body certain disintegrations which we recognise as fatigue, and which necessitate a cessation of the vibrations (rest) for the purpose of reintegration (repair). Now it must be plain, that if, under these circumstances, a given structure can respond simultaneously to vibrations of more than one kind, without suffering from the conflict of those vibrations, we widen the entrance for the admission of energy *quâ* energy. Thus if A represent a given vibration rate, of which P

stands for the breaking-point intensity for a given structure, then, when the intensity of the vibration has attained the point P, no more energy in the form of that particular vibration rate can obtain admission without disaster, but if a harmonic of that vibration rate, B, can enter without conflicting with A, then the problem of further stimulation within the breaking limits of the structure is solved.

In place of breaking point substitute fatigue point, and the same argument holds, namely, that a tissue stimulated to the verge of fatigue by vibrations of one kind, may be receptive of vibrations of a different rate and yet keep within the limits of exhaustion.

In the case of every drug there is a point at which the tissue upon which it is acting, fails to be favourably influenced,—at that point therapeutic action is exchanged for toxic. This point may very well stand as the fatigue point for the drug in question. For instance, a cell is saturated with the influence of a salt of iron so that any further administration of the salt is deleterious; here therapy halts, no more iron can be given, but this same cell may still be open to the influence of manganese or of arsenic, and, if these elements have therapeutic values, the stimulation of the iron may be supplemented with advantage by the manganese or arsenic stimulation. Again, in the use of a purgative the joint action of

colocynth pulp, Barbados aloes and scammony resin, as in the compound colocynth pill of the British Pharmacopœia, is probably as scientific a combination as it is an effective one; the variants in stimulation co-operating, yet not fatiguing or irritating, as might happen with a larger dose of any one of the three. One recalls here the experiment of Valisnieri, recorded by Paris:¹ this observer compared the actions of cassia pulp and of manna as laxatives, and found that by combining the two, a heightened action resulted, *i.e.*, not merely that the two effects summed themselves by addition, but that in some way their action shewed a further multiplication. This brings us to the statement first put forward by Dr. Fordyce as a law: that "a combination of similar remedies will produce a more certain, speedy and considerable effect, than an equivalent dose of any single one."²

What actual multiplication of effect takes place by such combination as Valisnieri's observation asserts, and this law implies, this is a matter difficult of experimental proof, but that advantage must accrue from combination is manifest on the grounds above stated, and that something may be said in favour of an intensification of effect by such means, will appear from the following considerations. When in a muscle fatigue is strongly developed,

¹ "Pharmacologia," 8th ed., p. 210.

² *Ibid.*, pp. 209-210.

we know from the teachings of physiology that a given stimulus yields a lessened contraction ; but Nature makes no leaps, and this condition of diminished excitability is not a sudden development, but will be led up to gradually as the fatigue point is approached. This being so, we shall on the face of things expect that persistence in the use of one form of stimulation will not be so advantageous as the introduction of another form, whose incidence will be upon parts comparatively fresh, the stores of energy of which have been less drawn upon. It is not now a question of running up the dose of the stimulant and maintaining it at the dividing line between exhaustion and effective response, but of keeping the dose well upon the hither side of fatigue, in order that we may maintain the action of the stimulants at the top levels of their effectiveness. This argument is really but a development of the preceding one, but it is of the nature of an *a fortiori* development, emphasising the reasons for combining. And what is true of one form of tissue excitability, must be true of all forms, since in each case the response to excitation involves the using up of a certain amount of a limited supply of energy. Whether, therefore, it be a muscular contraction, or a gland secretion, or a nerve centre response, the same must hold true for each.

The reasonableness of the adjuvans being securely established, we must next note that, as previously

stated, its action may be *homogeneous* with that of the basis,—of like nature, a kind of harmonic. Thus, when we combine digitalis with squill, we make use of two drugs of the same class pharmacologically, and in this case the weaker element, squill, reinforces the action of the foxglove. In like manner, in the compound catechu powder of the British Pharmacopœia, the astringents catechu, kino, and krameria are associated as similars; and in the combination of tartar emetic with ipecacuan the drugs, though drawn from the mineral and organic kingdoms respectively, are closely allied in their physiological effects, and each enhances the action of the other. The union of gum resins in the compound galbanum pill, of aromatics in the confection of opium and in the compound tincture of lavender, also of purgative principles in the compound colocynth pill: these are other instances of this form of combining.

The action of the adjuvans may be *heterogeneous* from the basis, either through action upon dissimilar parts or through dissimilarity in quality of action upon the same part. Thus, when we associate mercury with digitalis and squill, as in the well-known diuretic pill, we cannot regard the action of the mercury as in any sense like that of the digitalis and squill; yet in some way or other the combination works favourably. In Donovan's solution (Liquor Arsenii et Hydrargyri Iodidi) the arsenical and mercurial elements act in concert, though not

exactly in unison, since their potencies must have very different vibration rates. In the combination of iron with arsenic the like holds true, and in the much-used prescriptions of iron with strychnine, and of iron with quinine, we have similar associations of heterogeneous yet co-operating elements. Lead with opium; quinine with potassium iodide; calomel with antimony and with guaiacum, as in Plummer's pill: these furnish yet other examples of the same principle in prescribing.

We must be prepared, with the advance of investigation, for the disprovings of individual groupings as instances of the action of similars or of dissimilars; but this can be a matter of no real importance, since it is a mere question of detail, requiring only a shifting from one category into another, and affecting neither the principles upon which we endeavour to combine nor the aim we have in view.

To complete the formula of the prescription, there remains as end-term the vehicle which shall convey, —the name *Constituens* has been given to this term. Upon the qualifications, mostly negative, which should characterise this carrier of activities we have already spoken, and it is unnecessary to expatiate upon this.

In full, then, the prescription will include four terms: Basis, Corrigenes, Adjuvans, and Constituens, in order of merit. The Basis will stand as the nucleus or kernel, and will claim first place in the mind of the

prescriber ; upon this will come the Corrigens, which expurgates and enables a purer presentment of the Basis ; and upon this will follow the Adjuvans, which supplements or complements, meeting insufficiencies on the part of the Basis. The Basis is a primary conception, but the Corrigens and Adjuvans are ideas essentially secondary in their dependence upon the Basis, and upon occasion they are omisable : these three furnish the activities of the prescription, and these three only. Last in order will come the Constituens, which does but convey or present that which Basis, Corrigens, and Adjuvans supply.

Upon the minimum number *four* of the full prescription, we shall, however, advance, if need be, doubling this or that member, or multiplying even further ; and should any one protest, we shall point to such official preparations as the compound tincture of chloroform and morphia, the compound tincture of lavender, the compound decoction of aloes, the confection of senna, and such like, or to such unofficial remedies as chlorodyne, the success of which prompted the *Tinctura Chloroformi et Morphinæ* ; also to Warburg's fever tincture, the formula for which, now published, would do credit to the days of Sydenham. Such success, however, as this last-named preparation has achieved is a matter for our wonderment rather than for our rivalry ; some nineteen ingredients may not again work together so harmoniously, and therefore, as

we began by invoking the aid of Sancta Simplicitas as patron saint, so let us end by giving the prescription into her kindly keeping. Within that keeping we may be sure that room will be found for both Corrigenes and Adjuvans, in faithful attendance upon the Basis.

There is no necessary antagonism between simplicity and numbers ; all that simplicity shuns is disorder, all that she demands is orderliness, to the end that the action of the many may be unified. In this way diverse actions are so knit together that they become one in effectiveness, and thus when simplicity has charge of the prescription we may be assured that the ingredients, whatever their number, will be always a company, never a crowd—*e pluribus unum* will be her motto.

In this spirit it is permitted to combine ; with this in view, we may commingle : hence these rules which are framed to the reduction of the formula to its simplest expression. Cicero, it is true, had other things in mind when he bade us “mark . . . that this law, this rule, this prescript is Nature’s own” ; but since on the present occasion we also are claiming Nature’s sanction and her example, may we not justifiably borrow his words to express the belief that in the use of the elements of the *Materia Medica* this law (of combination), this rule (of association), this prescribed order (of admixture), will be found to be also of Nature’s own ordaining ?

CHAPTER VIII

DIÆTETICA

PART I

Tantum cibi et potionis adhibendum est, ut reficiantur vires non opprimantur (LATIN GRAMMAR).

HOW is it that, in spite of copy-book maxim and the grammarian's saw, still we go astray? Here in a nutshell we have the better part of the science of dietetics, and the interpretation of the success of so many and such varied regimens,—in one word, temperance. “So much of food and drink is to be administered, as will refresh and not oppress the powers of the body”: the matter could not be more admirably expressed, and if we will but substitute for the words food and drink, the words doctrine and learning, exercise and amusement, or better still include them all in the one formula, we shall so enlarge the scope of the saying, that it will become a precept worthy to be engraved over the portals of every school in the land, an

injunction to be laid upon every household of every nationality.

“So much of food and drink,” but how much is that? Unfortunately, from a scientific point of view, the application of the formula requires an estimation, on the one hand, of the digestibilities of the various nutriments, and upon the other, of the digestive energy *at call* in the case of each individual. Fortunately for us the solution of the problem does not depend upon the quantitative findings of science, but upon such primary endowments of our nature as instinct, and appetite, and the power we possess of recording our experiences, upon the one hand ; and common sense, and self-restraint, and the realisation of the higher purposes of nutrition upon the other : it is the few only who live to eat, the many who eat to live and achieve. The practice of dietetics, and the art, rest accordingly upon the accumulated experience of the race, and the discipline of the peoples, and from this point of view the question of eating and drinking is ethical rather than scientific, to be decided upon in that general court in which appetite pleads, and self-restraint gives judgment. In that court the pains and penalties are awarded to the intemperate, the temperate rarely appearing, except it be to meet some outstanding debts incurred by light-hearted ancestors.

Temperance then stands as the first law in diet,

and where it rules and common sense inhabits, the physician will rarely find a market for his wares. By temperance we understand that *via media* which runs betwixt riot on the one side and penury on the other;—it signifies moderation, or things in measure; it is the road along which we shall travel most safely, considering the whole nature of man, but it is not the most easy. John the Baptist, it is true, came fasting, but a greater than he came eating and drinking. The message of the Greeks was, “Know thyself,” the apostleship of St. Paul reads, “Restrain thyself”; and the first law of health,—spiritual, mental, physical,—will be found to depend upon a moral injunction.

The study of diet is a study in itself, it cannot be dealt with even in a long chapter, moreover it demands that it should be treated by one who shall have given himself whole-heartedly to the subject. All, therefore, that will be attempted in the following pages will be to touch upon certain aspects, which though fundamental have been wont to escape notice.

We are apt to consider that the question of diet is an individual one, that it concerns you and me alone; but that is not so, the influence of diet cannot be tested by the life of any individual, however long-lived; one generation will not suffice to determine its value: the life of the race can alone test this matter. In the present, the future is

potentially at hand, but until that future shall have become dynamically manifest, the full value of the present will not have been gauged. Somewhere in one of his lectures on dietetics, Sir William Roberts has it that the current opinion in Salford used to be to the effect, that vegetarianism, whilst to all appearances satisfactory enough for the individual, did not show well in the second generation. Now whether right or wrong in this particular instance, it is certain that this is exactly the kind of test to which a life dietary must be subjected, before we can be entitled to draw conclusions as to its value. Admittedly the germ, or parent cell, is as much a part of the body corporate as any other of the many tissues and organs which make up the whole ; but whereas these display their powers presently, that tells us nothing for the moment of the powers dormant within, and yet this is by so much the more important, that, whilst the several parts of the body exhibit in detail the powers parcelled out to them, the parent germ focusses within the limits of one cell the potencies of the whole organism. Here, indeed, is a microcosm, and when we consider that it is held by us in trust, but that we have no means of discovering how that trust has been kept,—worthily or unworthily,—until the future shall have disclosed it, we begin to realise the magnitude of the charge committed to our care. When we add to this the common knowledge, that for this disclosure we may have to wait until the third and

fourth generation and beyond, it must become evident that the life of the race alone will suffice to set forth the vital issues which depend upon the nutrition of the body. Our responsibility is proportionate to the greatness of the trust, and that responsibility will continue to lie upon us until maturity shall be past, and to the newer generation shall have been handed on the microcosm and its future,—then, and not till then, will our bodily responsibility shrink to the dimensions of the shadows that we cast.

This being so, conservatism should be the keynote of our behaviour, and it behoves us to walk warily in new paths, as we value the past. Each nation worthy of the name has records, upon which it looks back with pride, and its roll-call of heroic lives, in which are displayed at its highest the genius of the people. But diet is the soil which has given birth to those bright records and those strong lives, which, on the battlefield, at the stake, in every field of human activity have fought, endured, and wrought and won; and, contemplating such manifold achievement, we must indeed confess that the soil has been a fruitful one. What need of names? Let each nation fill up its own roll-call and see therein the claim which diet makes upon our gratitude. If the fires of the nations have been kindled and nurtured upon this, it must of a truth be strong meat, and we shall hesitate before we condemn and change. This does not mean that we shall tie our-

selves down irrevocably to the past, admitting no plea of changed circumstances. It means simply that we shall face the problem with the past in full view, and weigh and consider, and above all bear in mind that the single generation cannot determine.

Should it be objected that this matter presents another face, and that energies of a darker complexion have been born of this same diet, that the martyr has arisen contemporaneously with the inquisitor, the patriot with the tyrant,—the objection will be allowed. Even so, the diet must be admitted to be robust fare, and that it is not energy which has been lacking, but direction; and in any case the Ayes have it, the balance of power being unmistakably on the right side,—else could we dare to speak of progress, or join in the Psalm :—“O all ye works of the Lord, bless ye the Lord”?

The next point for consideration concerns the power of the organism to utilise the forces which the nutriments bring. Up to a certain point digestion may be studied in the test-tube and the retort, and in this way it is possible to determine the coefficients of digestibility of the various foods, by submitting them to the action of fixed quantities of definite digestive admixtures. The problem thus stated is purely chemical and comparatively simple; as a preliminary it is an essential step in the investigation. The difficulty makes itself felt, however, when we exchange the glass-walls of the retort for

the living tissues, and discover that the word digestibility now means something else, viz., the relation between the food and the quantity of digestive energy which its stimulus can provoke. We learn, further, that not only is the call which each food makes, a different one, the bodily state remaining a constant, but that even with the same food and the same organism, the response to the call varies with the bodily condition of that organism ; that is to say, one and the same organism is a variable quantity at different times. The subject bristles with difficulties ; thus in the first place we shall note that the power of extracting the nutritive constituents from the foods varies enormously with the individual, as well as with the bodily state of the individual ; next that the power of absorption, of storage, and of synthesis of these constituents, all which processes come under the head of assimilation, vary in like manner with the individual and the bodily state ; thirdly, that the power to develop at demand from these stored elements the energy of which they stand possessed, is again both individual and conditional. The powers of extracting belong to digestion proper, and the study of food remainders reveals the variability of this process. The powers of absorption, of storing, and of building up the materials prepared by digestion,—these are anabolic powers, and they bring about an accumulation of potential ; but in proportion to the *quantity* of this potential absorbed, its availability

in respect of its *site* of storage, and its availability according to the *stability* or *instability* of the synthesis formed, so will be the efficiency of the individual from the point of view of assimilation. The powers of developing energy from the potential stored are katabolic, and everything depends here upon the *completeness* of the katabolism, the reduction, that is, of the complex molecules to their simplest expressions, as well as upon the *rate* at which this downfall of potential takes place. Again, this is individual, and we shall observe great differences, according as the degradation of the complex molecule is arrested at this or that stage, and, escaping from the body, carries with it so much of unused potential; also according as the rate of downfall is fast or slow.

It is therefore quite useless to tell me that so many units of nutritive constituents have been administered,—so many grammes of proteid, carbohydrate or hydrocarbon,—and that these units, as the result of complete combustion, will develop so many heat units or calories: that which I want to know is, how many nutritive units have been extracted and stored by this particular individual, and how much of the potential energy so introduced will subsequently be available and be utilised by him. In this matter of utilisation a further complication arises: let us suppose that as the result of combustion within the tissues so many calories-worth of energy have been

realised how will that quantity of energy be utilised? The needs of the body are manifold: here so much mechanical energy is required in the form of muscular contractility, there so much electrical energy, dynamic or static: so much of heat for warming purposes is needed here, whilst there, chemical combinations have to be undone at the expense of so much energy, which, for the time being, is locked up as potential. Now does it follow, because so many calories-worth of energy have been realised, that this capital sum will in each case be transformed with equal ease and with equal economy; will there be no waste, no leakages, at each transformation of the one form of energy into the other; shall we look upon each human machine as a perfect transformer, developing always the full energy equivalent? Of course there can be no loss of energy to the cosmos, but there may be, there must be, to the microcosmos of the body, and so of the total heat energy; leakages not required for temperature purposes will take place here and there, and be got rid of by evaporation, contact or radiation, as waste products.

In the case of the steam-engine, to take one example from physics, we know that of the sum total of energy produced by the combustion of the fuel but a fraction is transmuted into its mechanical equivalent; and we know that this fraction varies greatly with the type of machine. It has been calculated that the human body is capable of

utilising, *i.e.*, of transforming, one-fifth of the total energy supplied as heat,¹ but this efficiency, remarkable enough as an indication of the perfection of the mechanism, stands as an average efficiency only, from which the individual divergence must be great.

At the risk of the charge of multiplying difficulties, reference must be made to another element in the problem, which, under another aspect, exhibits the variability of the individual organism considered as a machine. We are familiar in the case of machines of one type, with different grades of that type, according to the mechanical advantage which is presented; thus we have high-grade and low-grade machines, and we have also machines which, by a contrivance, can pass from one grade into another grade. In this way, by the presence of two or three gearings in one machine, we can get two or three speeds out of it. Now the point to be insisted upon is, that the human body is essentially a machine of many grades, and in this sense it is not one machine but many.

Hitherto it has sufficed to accentuate the fact of the individual differences between organisms, as well as the fact that the same organism will vary in effectiveness at different times, this latter variability being attributable to the more or less favourable conditions under which the mechanism works at those different times; always, however, we have had in

¹ Daniell's "Principles of Physics," p. 355.

view one mechanism only for each individual. But now the suggestion is made that there is definite provision in each individual for the working of the machinery at different rates. That in other words we are so fashioned as to be able on occasion to extract and utilize more or less from a given quantity of energy, presented in the form of food. Will any other hypothesis explain the remarkable differences which we witness in the same individual in its power of food-utilisation? We recognise in ourselves that we can and do live at different levels, that at times vitality is at a low ebb and our productiveness so deficient that we may be said to vegetate; whilst at other times we are, by comparison, so brimful of energy that we scarcely recognise ourselves. Sometimes the passage from the one state to the other is by insensible degrees, and like to the tedious convalescence from a sickness; whilst upon another occasion the individual passes at a bound from the passive into the active condition. So different is the one from the other, that the two resemble the allotropic modifications of substance which the chemists show us: here phosphorus in the red inert state, there in the clear state, luminous with energy.

Moreover, we may note that the form characterised by its energy may be developed, and proceed upon a diet, poor as compared with that upon which the form characterised by its inertia has subsisted. The determinant of the change of

state from torpid to vivid, and *vice versa*, may be of the most subtle nature,—a word of encouragement may raise, a word of discouragement lower, the plane of vitality. History affords a striking instance of the kind in the case of the boy king Charles XII. of Sweden, in whom the deep emotion caused by a betrayal, gave rise to a concentration of the exuberant energies of youth within the bounds of an inflexible purpose, whence came the figure of the soldier hero whom the world yet remembers. But many a man who lounges through life faring sumptuously, and strolls out of it in the same delicate way, has within, though never called into play, the higher grade mechanism of the “*vir strenuus et fortis cui deerat timor mortis*” who lies buried in Tewkesbury Abbey. In point of fact the man who fares sumptuously, starves in respect of the energy which he extracts and develops from his superabundance, whereas the man of strenuous life is filled to overflowing with the dynamics of the food particles of his meagre diet.

The will is credited with playing an important part in the more vivid life, as indeed in life on any plane. This view is well illustrated by an anecdote: certain physicians had met in conference over a case of serious illness; the patient, an iron-master, being judged to be past recovery, it was thought right in the circumstances that the patient should be told so, and one of the physicians was deputed

to convey the opinion. Accordingly this was done, and the hopelessness of the outlook placed before the patient as clearly, yet as tactfully, as might be ;— “What,” exclaimed the sick man, “die ! die, when pig-iron is at so much a ton,—never !” And life went on, seemingly at the bidding of an imperious will. Of course we shall be told that the will played no part here, that it is impossible that a mere subjective epiphenomenon could determine anything ; how should an accompaniment do this, and that too—a semblance only ! How indeed,—and yet, since there are some things, according to Pascal, “whereof the understanding knoweth not,” some of us will be content for the time being to accept the semblance as the reality, and to believe that in a case such as this, the will may be not only a factor, but a determining initial factor ; that the error in judgment lay with the physicians, who, accustomed to view life on a lower plane of vitality than here obtained, had failed to gauge the situation aright, and amongst other things to see in pig-iron the one stimulus needful to incite the will, and place at its disposal the reserve powers of the higher grade machine. Be this as it may, we shall all agree that the manifestation of the will power on the side of life, whether in reality or in semblance, whether as determinant or as accompaniment, will indicate that the fight is being fought with the keenest weapons at command.

In the problem, therefore, of the diet required

in a given case, be it of health or of disease,—it matters not one whit which,—we shall have need to know, in addition to those points already insisted upon, whether it is the higher or lower or the middle man who is to be fed. Heaven spreads the table for all, we partake ; but of that which is partaken how much do we appropriate ? Everything depends, in a sense, upon the spirit in which we sit down to the repast.

These are no isolated facts ; we meet with kindred truths each moment of life. The landscape is there for us all, but how different its appropriation by the individual ; yet the same externality has ministered to the senses of each and of all. The block of marble confronts us,—to me it is four square, and its contents so many cubic feet of stone ; to you it bears the same outward appearance, but within is a Dying Gladiator or a Laocoon, according as the spirit shall extract the potentialities. Unto many, the primrose is the “yellow primrose” which Peter Bell saw, unto some its intension is as fathomless as Tennyson’s “flower in the crannied wall.” For the mind, as for the body, the externality is, we assume, the same, but the internality is as inconstant as the individual personal capacity.

No lesser appreciation of the magnitude of the problem will be spacious enough to contain the *dramatis personæ* of Life, if considered only from so material a standpoint as meat and drink : on the one hand locusts and wild honey, preaching

in the person of the Baptist, on the other the sumptuousness of a banquet ministering to the magnificence of a Lucullus. And if we see the grosser pleasures of the table taking shape and form as swine, under the wand of a Circe, so we see the bread and water of the anchorite's cell spiritualising itself in the devout life at the Divine bidding. This matter which so adapts itself to the life it sustains, shrinking as it shrinks, expanding as it expands, now exalting, now debasing,—what is it but a great mystery! In its presence, dare one suggest that the denotation of the word Life has been too limited; that planes of vitality at higher and lower levels make up the sum of all things; that differences of higher and lower alone separate; and that no other kind of demarcation divides things animate from things inanimate, so called? Except this be done, the miracle of the creation of life is a daily, an hourly act; for do not bread and meat at each repast take shape and form; having become incorporated, do they not walk, talk, feel, think, will, believe, and give expression to every attribute of life? Now one of two things must obtain here: either this incorporation in fact, the dead matter at the touch of the living putting on life, or, not less incomprehensible, the dead matter imparting life without actually putting it on: in either case Life the positive, upheld by Death the negative. The common conception of life and death is that they are antithetic and mutually

exclusive; yet here have we matter, dead at the outset, or killed utterly by the ordeal of fire through which we have put it in its preparation for our food, and this matter it is which imparts that which it does not possess, namely, vitality;—back again we find ourselves, with Lord Rochester, at the begetting of Something by “primitive Nothing.”

All such difficulties vanish if we allow that there is no such thing as dead matter; that the plastic something which underlies all material manifestations holds always life in some degree, and that by virtue of this holding it is qualified to contain it in all degrees. We perform a combustion of the living tissues of a plant in order to determine its percentage composition, and the particles of carbon which we chase out from their molecular groupings in the living protoplasm of the cell, appear in the atmosphere as carbonic acid molecules, dead as fire can make them; these same particles absorbed by the growing plant re-enter the cycle of plant life, and put on again all the attributes of this life:—Were they ever dead?

Regarded in this light there will be no such thing as bio-genesis and abio-genesis, and we shall speak not of *omne vivum ab ovo*, but of *omne vivum ab initio*, and with this we shall arrive at the primal mystery, not to be solved here. The dignity of matter will thus declare itself worthy of any trust.

How then do we stand; what conclusions have we reached?

I. That in health the question of eating and drinking rests upon a basis whose foundations have been determined for each nation by experiment,—the experience of the race; and that, provided we inculcate temperance, we may leave the matter broadly there. The diet in our own case is a sufficient one; it has borne good fruit in the past, it has brought us to the point at which we now are, and we have no reason to doubt that it will bear good fruit in the future. The first recipe in the “*Forme of Cury*, a book of ancient English Cookery, compiled about A.D. 1390, by the Master-Cooks of King Richard II.,” is for the preparation of “*gronden benes*,” beans stripped of their hulls after baking, washed well, steeped in good broth and eaten with bacon; after more than five hundred years the dish of beans and bacon holds its place, and is likely to stand for five hundred more.

Common sense will tell us that the broad outlines of diet will call for modification according to circumstances; that life in the fields and life in the town will make different calls; the life contemplative and the life executive. Whether, therefore, we “chase brave employments with a naked sword throughout the world,” or, with the running pen, pursue the elusive thought through the tangle of words, so shall we perceive the need of adapting the diet to the requirements. The records of others who have gone before upon these diverse lines are there, and we are presupposing health and common sense.

II. That in the next place, the life of the race, and not of the individual, must be the touchstone of diet, and that for any one to claim precedence for a special regimen on the grounds of a high individual standard of health, a surpassing vigour of mind and body, an unmatched blood-count, etc., is wholly unwarranted, even if we allow the excelling claims. With equal justice might one award the merit to the parents of the individual, for whence derived he the constitution which has made such good use of the diet in question? And upon what fare did the parents subsist when they built up this new life which is so triumphant? And what will the children and grandchildren have to say upon this point? As anticipating the future, such claims are premature; as ignoring the past, they are immature.

III. That the difficulties in the way of a scientific estimate of the subject of dietetics are great; and that until we can more effectually determine the individual power to extract and store potential, and, having stored, to convert this potential with the least possible waste into the various forms of active energy manifested by the tissues,—it is useless to count up the number of heat units supplied in the food.

IV. That the problem is complicated still further by evidence, which suggests that the individual organism is so fashioned as to admit of varying rates of living; that, for instance, in states of

mental and spiritual elevation, also where a strong will is dominant, the body presents a different co-efficient of food utilisation than in states of mental and spiritual depression, or where the strong will is dormant.

It is customary to measure health and vitality by length of days, but, if the above be true, is the measure a sufficing one? That which we require to know is the productiveness of the machinery, its efficiency; thus if the life of one machine is five years, of another ten, yet, *cæteris paribus*, the former yield more work in those five years than the latter in twice the time, the former is clearly the better machine, and measured by productiveness it lives a longer life; mere length of days, therefore, will justify neither a constitution nor a diet. Count Cornaro drinks his fourteen ounces of thin wine, and consumes daily some twelve ounces of solid food,¹ and he travels through one hundred years of living, at *petite vitesse*. St. John the Evangelist, it is rumoured, attained also to the age of one hundred years; but whereas this one will be admitted to have fully justified his existence in the eyes of the world, it will be no disrespect to the Count, whose efforts on behalf of sobriety were very real, to say that these two lives must have been lived on wholly

¹ Discourse on a sober and temperate life, by Lewis Cornaro, a Noble Venetian. Translated from the Italian original. London, 1779, p. 38.

different planes, and that hence, whilst the one is well-nigh forgotten, the other as a living force still moulds mankind. How gladly would one know in its ponderable form the meat and drink of Saint John.

CHAPTER IX

DIÆTETICA (*continued*)

PART II

Condimenta adjectiva, Stimulantia

"*Os hebes est . . .*

Et queror, invisi cum venit hora cibi."—OVID.

FROM the Indies, by way of Damascus, Aleppo, Venice, Genoa, and Pisa, there came to the hands of the master cooks of King Richard II. of England those spices which were to qualify the royal dishes.¹ These "*condimenta adjectiva*,"² as Dr. Lister called them, were already at that time venerable in the world's history, and they have persisted unto the present day in undiminished repute : what may be the significance of a usage of such antiquity ?

If we look into the structure of these spices we

¹ "The Forme of Cury," &c., edited by S. Pegge, 1780, p. xxvii.

² Ibid., p. iv.

discover that in their essentials they consist of certain molecular groupings of carbon and hydrogen, for the most part, but often accompanied by products of a partial oxygenation ; these groupings constitute the volatile or essential oils, as they are termed, a class, for the rest, somewhat heterogeneous. Potentially by their structure these bodies are force bearers, since by oxidation they are capable of simplification with the setting free of energy ; but whether such oxidation within the tissues obtains or not is of no practical consequence, inasmuch as the volatile oils can find entry into the system in negligible quantities only ; this is due to the smallness of the dose which the intensity of their action necessitates. They cannot therefore in any real sense take rank as foods.

In the eyes of many, the spices, as food adjuncts, will figure rather as elements which minister to the artistic side of dietetics, and make possible the subtleties of cooking as a fine art : elements which appeal to the refinements of taste and of smell in much the same way as the gilded leaves and other adornments of the dish, at one time customary, made their appeal to the eye, and gave completeness to the culinary effort as a whole : elements disguising the grosser aspects of the baked meats, making apology to the higher man for the needs of the lower, and as nutritional accompaniments playing as much and as little part in the great function of assimilation as the

flowers on the table or the attendant strains of the orchestra. Unto those who may regard the spices in this light it will be evidence of the store which people set by such artistic effects, to note the prices which they were willing to pay for these embroideries of the feast—thus at the marriage of a daughter of Sir John Nevile of Chete, in the reign of King Henry VIII., we read on the roll of provisions, “item 10 pigs, every one 5d,” and further on, “item 1lb of cloves and mace, 8s.¹

This was indeed art for art's sake, if here was their only meaning, but such is surely not the case, and to the spices we must allow another quality, viz., that of conveying a definite stimulus to the digestive organs, evoking on their part a corresponding response. Other things being equal then, the dish which has been seasoned with judgment will excite a fuller digestive reflex than the unspiced dish. Now it is certain that that condition of the body is the more robust which responds by an adequate reflex to the plainer fare; that, otherwise expressed, the better the health the less the need for condimental adjuncts, and it is no less certain that the immoderate use of spices begets a craving which is distinctly morbid. Between these extremes, however, there are bodily states, especially among dwellers in towns, which we may not regard as morbid, and which

¹ “The Forme of Cury,” pp. 168, 169.

appear to respond more effectively to the tasty dish, which thus, by virtue of the contained condiment, becomes *pro tanto* the more digestible.

We know well how slight are the determinants of digestibility and indigestibility ; that the solitary meal, for instance, may mean so much of laboured assimilation and so little of bodily refreshment, whereas the presence of a congenial friend at the same repast may suffice to completely reverse the order of events. In that case the pleasurable excitement caused by the companionship tunes up the nervous system to a pitch which causes it to answer more readily to the food stimulus ; whereas, in the use of the spices, it is the food stimulus which, being accentuated, serves to call forth a more vigorous reaction. As digestive adjuvants, enforcing the food stimulus, the condiments will accordingly take rank, — herein lies their philosophy.

It is probable that at times the value of the condiment will be that of the corrective rather than of the adjuvant proper, but when that is the case, either we shall have passed from health to disease, and the correction will be of the morbid state of the mucous membrane rather than of the food ; or, if we be still within the limits of health, we shall be dealing with certain of the foods more difficult of assimilation : thus it is the fatty or richer kinds of food which, in particular, seem to call for the corrective action of the spice. Indeed the con-

diments belong almost as much to the dispensary as to the kitchen; to them must be granted undoubted antiseptic powers, and in the pharmacopœias they figure somewhat prominently, chiefly in association with bitter and with purgative principles,—but then it is under the heading of *carminatives* that we meet with them. Into their medicinal value we need not enter,—we are dealing with dietetics, and we may fittingly end this part of the subject with the concluding sentence to our list of recipes of ancient cookery, of date A.D. 1381:¹ “Explicit de coquina que est optima medicina,” in full agreement with its statement that the kitchen is the best drug shop—provided always that it will suffice.

We must now pass to the consideration of a class of bodies belonging to the table, yet not to the kitchen; of widest custom, and of usage as ancient, if not more ancient, than that of the condiments; namely, the wines. In its broadest sense the term wine is applicable to the product of alcoholic fermentation of any sweet juice, but the juice *par excellence* is that of the grape. Wine is a liquid of complex constitution, but its interest centres in one ingredient, *alcohol*, around which the other qualities of the liquid group themselves in becoming subservience. Into the question of the complexities of wine, its ethers, contaminant higher alcohols, etc., we need not enter; it is with

¹ Pegge's “Forme of Cury,” p. 122.

wine as a whole that we are concerned, or rather with its main ingredient, alcohol, and to this we may with advantage confine our attention.

Alcohol conveys a stimulus, so did the condiments, and without doubt there is a resemblance in the mode of action of the two classes of bodies ; but whereas in the case of the spices we retain the use of the word condiment, though recognising in their action a form of stimulation, in the case of alcohol, so impressed are we with this aspect of its operation, that the word stimulant has become synonymous with that of the entire group of alcoholic beverages. Alcohol, therefore, as the stimulant *per se* stands as a type.

Two atoms of carbon, six of hydrogen, one of oxygen—such is the composition of the alcoholic molecule ; and within the compass of this grouping we shall see, if we look closely, both Noah's abasement, and the gladness of heart at the feast of Cana : of a truth this atomic structure is well named a spirit.

How does it act? If we compare it with the bulky molecule of a fat, say tri-palmitin, with its fifty-one atoms of carbon, ninety-eight atoms of hydrogen, and six atoms of oxygen, we perceive that the relative proportion of oxygen in the two molecules is very unequal, being much less in the fat. This is made more manifest by multiplying the alcoholic molecule six times, in order to bring up the oxygen contents to the same figure as

that of the fat molecule ; this will make no change in the proportion of the elements. We shall then have the alcoholic grouping represented by twelve atoms of carbon, thirty-six atoms of hydrogen, and six atoms of oxygen, and subtracting these figures from those of the fat grouping, we have in the latter a balance of thirty-nine atoms of carbon and sixty-two atoms of hydrogen wholly unoxidised. Supposing, therefore, that *equal weights* of alcohol and of fat suffer complete combustion into carbonic acid and water, more oxygen will be required for the latter, and therefore a correspondingly larger amount of energy will be liberated by the same. These relative combustion-heats will actually measure the quantities of heat available by the economy, for since the products of the burning, carbonic acid and water, are in each case the same, we need not trouble about *calorific intensities*. Assuming, therefore, complete combustion within the body, alcohol will not be so good a fuel as fat ; by the same reasoning it should be a better fuel than the carbohydrates, of which a molecule of glucose, $C_6H_{12}O_6$, may stand as representative.

Whether the nature of the fuel makes any difference in respect of the convertibility of the energy generated by combustion into the other forms of energy required by the body, is a speculation hazardous to raise and perhaps wholly unjustifiable. If so, then all that we need in order

to establish the position of alcohol as a food is to prove that it is burnt within the tissues. The answer to this much vexed question seems at last to have been arrived at, and we now learn, on the basis of very positive experiments, that some 95 *per cent.* of the alcohol ingested is consumed, and probably converted into carbonic acid and water, since, with the exception of traces of aldehyde, intermediate products are not found. This settles the question once for all: alcohol is a food, for it liberates energy within the system, and this energy, if utilisable in its lowest form only, viz., as heat, will serve for temperature purposes and in place of other kinds of fuel.

But it has other actions; what are they? The poets say, also those, whose theory it is that life is to enjoyment, and who constitute the revellers in all ages,—these say that wine bestows a genial warmth, a quicker life, a freedom from restraint; that under its influence the ideas flow more easily, the tongue is loosened, doubts, hesitations dispelled, the vision cleared, cleared that is of the spectres which walk by day. In this belief others share, and even the Psalmist confesses that “good wine maketh glad the heart of man.” From this purely subjective estimate let us turn to the physiologists for their pronouncement. Unfortunately they are not agreed; for whilst some hold that alcohol (we are considering the effect of *moderated* doses only) is a true alimentary stimulant and digestive, others

regard it as an irritant rather, and as a retarder of digestion ; again, whilst some hold that its action upon the central nervous system, higher and lower, is primarily stimulant, others there are who maintain that from the very beginning the action is depressant ; and they explain the apparent quickenings of function as in fact paralyses of control,—withdrawals, *i.e.*, of those checks and curbs which in the saner life should have sway. Hence, according to them, the more ready flow of ideas, *of a kind*, hence the loosening of the tongue, and they argue that the disappearance of doubts and hesitations is because the centres which should be alive to the warning signals have been made drowsy ; that, in other words, the clearing of the vision signifies, not an effacement of line in the picture, but a lack of receptivity on the part of the beholder. Even in its action upon the vascular system we shall not find agreement, for it cannot be disputed that the quickened pulse and flushed surface are compatible either with a more forcible contraction of the ventricles, the result of a stimulation, or with a diminished control over heart and vessels in consequence of a depressant action upon the regulating centres.

So stand matters physiologically, but whilst the camp is thus divided upon the question, it will probably be admitted by most observers that the balance of expert evidence is in favour of stimulation as against depression, and certainly it will be

allowed that in medical practice the assumption that alcohol is a stimulant is almost universal. This being so, and traditional thought and usage being in like sense, as also the current opinion of the majority of mankind, it will be safest to hold to this view until better evidence in disproof is forthcoming.

That alcohol is harmful when the strict limits of moderation are overstepped, none will deny, yet is there any evidence worthy the name to show that, enjoyed temperately, it is mischievous physically or morally? But if it do no harm then it must do good, for are we not left with the *plus* quantity, enjoyment?

Should any one ask for the definition of temperate enjoyment, it must be replied that it is one thing for one man, and another thing for another; and that, provided there be the desire to control, the knowledge of the boundary line between enough and too much will not be withheld. "Stay at the third cup," says George Herbert, which cryptic utterance the context interprets, alas, as—do not drink it. There the injunction may stand, without seeking to define either the size of the cup or the strength of the liquor,—“Stay—at the third cup.”

Having assumed that alcohol is a stimulant, it is needful that we should have a clear conception of what we mean thereby, for this question of stimulation is much larger than that of the nature and action of alcohol, or of any one substance, dietetic

or medicinal. We understand by the word stimulant a something which causes the liberation of an energy which, itself, it does not bring. We prick a sensitive surface, the stimulus of the prick travels centripetally ; having reached the centre, it unlocks a dose of energy, which escaping along centrifugal lines manifests itself in a muscular contraction. The energy loosed by the prick is not its equivalent, neither is there any fixed quantitative proportion between the two. The theory of the action of a stimulant demands therefore the presence of *stored energy*. At the instance of the stimulant the body spends of that which it has hoarded. Accordingly, when we speak of alcohol as a stimulant, we use it in this sense, viz., that it is able to set free and make dynamic the potential energy which the tissues have amassed. Now the tissues have a current account and a reserve fund, and the theory upon which the stimulant is applied is that on occasions, crises they may be called, when the working of the machinery threatens to halt through lack of energy, the stimulant sets free the supply needful, and the danger is averted, *for the time being*. Obviously the process cannot go on indefinitely, its time limitations are determined by the amount of the capital of energy possessed by the individual, and the drafts upon that capital,—no stimulant has ever yet made a successful appeal to a bankrupt state, for the simple reason that it brings no energy with it and that there is none which it can unlock.

When a patient is in collapse, we may wrap him up in hot blankets, and the stimulus of the heat, *quâ* stimulus, may share in the reviving; but in that case something more is being done than a mere irritation of afferent nerves, for we are actually pouring in heat energy to make up for the deficit in the sick man's body. Action such as this is outside the definition of the word stimulant as we have given it. It is true we often do make use of heat for purely stimulant purposes to secure a desired local or reflex effect, but such application is as a rule local, and more often than not we conjoin the use of some irritant, such as mustard or turpentine, to enhance the action. In these cases we ignore the influx of heat as a factor in the situation, we have no need of it for temperature purposes. As examples of the purer forms of stimulation we may instance the flash of a bright light, a sudden loud noise, the Faradic application: the energy which these bring into the body may be minimal, yet the violent start to which they give rise may be maximal.

Alcohol, as we have seen, is a food, and as a food it brings energy into the system, but this energy is developed slowly and as it is developed the alcohol ceases to be; whereas the stimulant action of alcohol is a quick development, and we have reason to believe that it depends upon an unchanged molecule; we must therefore dissociate these two modes of action of alcohol.

Examining more closely into this matter of stimulation, we become aware of two forms of stimulants, those which let loose actively and those which facilitate the letting loose: the difference is that between the pulling of the trigger and the greasing of the lock. The life of the body is in great part automatic; some will say, from beginning to end; all will say that in its unconscious and subconscious workings it is so. Such life is composed of innumerable reflex acts,—stimuli presented, accepted, reflected; each stimulus pulls the trigger, each acceptance liberates the energy of the charge, each reflection directs that energy. Stimuli are never lacking, but the condition at the centres may be such that the incitations are insufficient, and when that is the case the *stimulant* so-called may act either (1) by reinforcement of the incitation or (2) by lowering the stability of the centre, so that it now responds to that which previously was ineffectual.

A more general statement would probably meet the facts of the case better than this, which implies that the centres in the nervous system are the only sites of the unlocking of energy; for the charged cell may be peripheral as well as central—witness the muscular contraction and the discharge of energy which it signifies, when compared with the stimulus which has provoked it. Conceivably, therefore, the stimulus may act anywhere along the line of the reflex arc, and in like manner any-

where along the same line the irritability to the stimulus may be heightened, that is, the presentation of the stimulus facilitated. Either mode of action leads to the more ready liberation of energy, and either may prove equally effective. The action of strychnine is regarded in general as of the latter kind, the nerve centres being rendered by it more sensitive to stimuli :—it may typify this class of stimulants. Does alcohol come into the same category, or does it rather help to pull the trigger? It will be wiser to leave the answer of this question to others and to be satisfied now with the establishment of these two modes of stimulant action, by one or other of which alcohol will operate.

To return from the general to the particular, let us think how we may best employ the qualities which alcohol possesses. It is a food, undoubtedly, but all things considered it must be admitted that it is a bad food ; for whilst as such it brings in force, as stimulant it liberates force, and since the quantitative determination of the one and of the other is a matter of great difficulty, a problem moreover varying with each individual, it will be hard to decide whether the system is the richer or the poorer for its administration. Alcohol, therefore, should not be given as a food.

We turn to its powers as a stimulant. In order to utilise these, we should so administer the stimulant that the energy liberated by it may work

to the advantage of the body. Now to give a dose of alcohol and under its influence to exact so much muscular effort, measured in so many foot-pounds, is bad economy ; in that case the extra labour is paid for out of the privy purse,—it is unremunerative. Evidence upon a large scale has demonstrated that alcohol is not advantageous when bodily fatigues and labours of all kinds have to be undergone, neither for like reason is it to be used to stimulate productiveness when the field of labour is amongst ideas—and this quite apart from the fact that its effect upon the mind appears to be to loosen rather than to connect its workings. No, in order to secure a remunerative effect the stimulation must be reflected upon a process which itself is directly beneficial ; such is the digestive process. If alcohol will start a languid digestion, if it will secure a better food reflex, then the energy set free by it will be repaid in the form of an improved assimilation. Alcohol must therefore always be given in connection with food, and to the assistance of the digestion. It may not be required by the vigorous constitution, well and good ; it is then unnecessary, but even then, if in strict moderation it provide an enjoyment, which, because innocuous, is wholly innocent, why disallow it? *Nihil obstat,—bibatur.*

In disease it is another story : there we are often confronted with the problem of a low anabolism and a high catabolism, and withal reserve powers still locked up within the tissues, although unavailable

for this or that reason. It is then that we face a crisis, and that we may be called upon to run the risk of bankruptcy in order to gain time. But even then the administration of alcohol as an unremunerative stimulant should be as a rule with food, for, besides the convenience of this, it may assist in the tolerance of the small doses of nourishment, at frequent intervals, to which we are then often driven. The longer the prospect before us of the duration of the illness, the greater should be our reluctance to begin with alcohol as a stimulant of this kind, for the greater is our need to economise the vital forces ; the shorter the prospect, the more lightheartedly may we proceed in this matter : thus in the collapse of snake-bite we are wont to pour in the alcohol with a free hand, whilst in the exhaustion of typhoid fever we begin hesitatingly, and advance the dose cautiously.¹

To treatises on the details of practical medicine we must refer for the rules for the administration of alcohol in disease—these belong to the *Secundo prodesse* and are not strictly in place here.

To the table, but not to the kitchen, neither to the cellar, belong tea, coffee, cocoa and their congeners. These dietetic adjuncts are not essential,

¹ It used to be a dictum of Sir William Jenner's that if in doubt as to the administration of stimulants in typhoid fever, he withheld, whereas in typhus under similar circumstances he gave.

we must acknowledge it; a ruder and more mettlesome age knew them not, and great achievements were realised without their aid. Introduced into Europe about the middle of the seventeenth century, it is said that Louis XIV. was the first in France to sip his cup of coffee in 1644; ¹ true, these innovations in Western life coincided on the Continent with the *grand siècle*, but in our own country the ardour of the Elizabethan age had by that time yielded. Shakespeare and Bacon had written and Sir Philip Sidney had died, and both here and abroad the fever of the Reformation had passed its crisis. It cannot be claimed, therefore, that tea and coffee are necessary incentives to great deeds. How long the custom of tea and of coffee had existed in the East none can say, but here in the West great things had been done before their advent, and now that we have before us this same custom grown into an universal habit, and prevailing along with a luxury unknown in former times, some there are who think they detect the signs of a decadence: is the contemplative indifference of the East to become our portion, and in turn are we to sit down and let the world go by?

Tea, coffee, and in lesser degree cocoa, rank as stimulants; their action depends upon principles which, in the several members of the group, are either identical or closely allied. This action falls

¹ "Dictionnaire de Matière Médicale," Mérat et de Lens, art. "Coffea."

upon certain systems in particular, and notably upon the nervous, circulatory and renal systems. The predominant action appears to be upon the central nervous apparatus,—certainly it is because of this effect that tea, coffee, and cocoa are drunk as beverages. The removal of the sense of fatigue, the mental refreshment, and the capacity for renewed exertions both of mind and body which they bring about, are familiar experiences. In contrast with the action of alcohol there is no loosening of the mental processes; ideas flow, not because the restraints are removed, but because apparently the plane of activity of the brain has been raised. The judgment is, if anything, more critical, the perceptions more acute, the capacity for sustained thought more pronounced. For these reasons tea and coffee have become the companions of workers in all classes, travellers, men of letters, men of science, men of business, nurses,—of all in fact upon whom the circumstances of life tend to make special demands. From the fact that the perceptions are quickened one must infer that the stimulation of this group heightens the excitability of the nervous tissues, the potential of whose cells is more readily liberated, a mode of action strychnine-like, as we have defined it.

These bodies, the food accessories, enable, therefore, the extraction from the nerve centres of the energy which they have stored; do they bring anything wherewith to replenish? Of this there is no

evidence, for if we regard the quantities in which the caffeines, theophyllins and theobromines gain entrance, it must be clear that, as in the case of the condiments, we may neglect their oxygenation, however complete: they are not foods. Accordingly, if these substances serve only to empty the system of force, their use must be in strict dependence upon those other processes of assimilation which make full. In particular must this be a time-dependence, the intervals between the employment of the stimulants being sufficient to allow of a complete recharging of the nerve cells. Moderation, sobriety, temperance, are therefore as imperative in the use of the teas and coffees as in the use of alcohol. Cocoa scarcely calls for the same serious consideration, and for two reasons: (1) because it is generally made to convey a food-stuff, and (2) because its active principle is so much less potent, as administered, that it may be said to stand to tea and coffee much as lager beer stands to the more potent ales and wines.

"Wine above all things doth God's stamp deface," says Herbert, herein lies its great condemnation, but at the same time its great safeguard, for its defamation is in the sight of all men. Excess, therefore, labels itself, and even where excess consists in the frequent repetition rather than in the massive dose, and the open shame of drunkenness is avoided, yet the effects in the end are so telling that we cannot complain of the absence of

danger signals. It is otherwise with the abuse of tea and coffee ; the nervous wrecks of whom we see so much, the sleepless, irritable, uncontrolled beings, victims of a habit, the disaster of which is perhaps scarcely less great than that caused by the abuse of alcohol, these indeed make claims on our compassion rather than our disgust, and for no better reason than because they do not wallow. Indubitably the tea-shop is upon us, and the neurasthenic ; and what our heirs and assigns will say of the nervous system which we, after flogging it all our lives, have handed on to them to take charge of,—if nervous system we dare call the empty irritable thing,—this should be instructive. The early morning cup of tea, the breakfast with tea or coffee, the coffee after luncheon, the afternoon tea and again the coffee after dinner !

Theobromine, of this class, derives from the Greek its signification of divine food, and the name is applicable to the whole group, for divine they are in the refreshment which they bring. Charging and discharging, filling and emptying, these are processes which appertain to the healthy life ; and it is only when we fail to apprehend this, and, not seeing that the one process demands the other, ignore the inexorable equation ; then only is it that we commit excess and prepare in the near or far future the inevitable breakdown. Condiments, stimulants, alcohol, tea, coffee, all,—foods and food accessories alike,—are gifts of the gods ; by excess

alone are they perverted into fruits of evil. Of themselves they are neither good nor bad ; according to their use do they testify : enjoyed temperately, we may say of each and of all, "*Gaudeamus igitur.*"

CHAPTER X

HABIT

"Consuetudinis magna vis est" (CICERO).

IN the foregoing we have been content to regard the theory of stimulation apart from the question of by-effects, though such effects may accompany the action of the stimulant, and on occasion suffice to disqualify it; thus tea or coffee may act so deleteriously upon the digestive organs that the use of either has to be discontinued. This knowledge is familiar enough to render it unnecessary that we should go further into the matter, and this is the less needful because no principle is involved; it is otherwise, however, with a subject which belongs essentially to the routine use of any and every thing, and which the food-accessories in particular bring into prominence, to wit, habit:—this calls for consideration.

It is proverbial that custom is second nature; immemorial experience has established the truth of this proposition, and science has set forth its

reasonableness, and yet in every-day life it is ignored in the most flagrant manner. Thus it is that in this era of new things and newer remedies scarcely a week passes that some product of the laboratory is not launched on the sea of therapeutics, as a matter of course with a flourish of trumpets, and more often than not the tale of its benefactions ends with the statement that it begets no habit.

If the promoters of this new medicament had but given the matter even a passing thought they could not have failed to recognise that with this last statement they were cancelling with a stroke of the pen the long list of activities they had just been enumerating. For, is it possible that a substance shall give, and its withdrawal not make itself felt? Indeed, must it not rather be that in the direct proportion of its activities, in the exact measure of the benefits it bestows, so will its absence be missed, so will its presence be craved? That the law of habit should manifest itself in all degrees would *a priori* be expected, though that it should hold so strongly for this substance, so weakly for that, may be difficult of elucidation. We do not apply the term "habit" to those processes which ages of routine have organised until they have become fundamental, yet the force of habit is nowhere so exhibited; for, change the nature of the atmosphere, and a *besoin de respirer* arises which, through stages of acutest distress, culminates in death;

withdraw the due supply of water or of aliment, and death by thirst or by hunger follows inevitably. The term habit is reserved for such processes as are accessory but not essential to life. The claim of these upon the body is that they convey a pleasurable excitement, but unfortunately this latter is no measure of the real advantage to the system, and frequently it is just the reverse. Why we should have the power to enjoy to our own hurt is a mystery, why self-restraint should be essential to the higher life is equally obscure, but that it is as fundamental to this higher life, as air and water and the aliments are to the organic life, is quite certain.

Since in the nature of things every stimulus long continued must beget habit, and since it is the tendency of habit to grow in force until, in the absence of self-restraint, it outruns control, it is desirable that we should inquire how this comes about. As we have seen, the life of the body is very receptive of, and marvellously adaptable to, the play of outside forces, and hence, when any new force, not too violent in its action, makes its appearance, a balance is soon struck, and the force, absorbed, becomes part of the corporeal system. This involves a new equilibrium which is the outcome of the action of the new force and the reaction of the system. Now the longer this action and reaction endure, the more organised does the new equilibrium become, and the less will there be of those perturbations which attended the incorporation

of the new force, until in the end a fairly stable condition will have resulted, with the *vis inertiae* all in its favour and against any further disturbance. But it was those very perturbations which gave pleasure, and as they have subsided, consciousness, less and less stirred, will have yielded to the sub-conscious, and thus by degrees the new force as a *conscious* element of life will have disappeared. The memory of the pleasurable, however, will have endured, and to revive it in fact,—to recall to life the pale ghosts of reminiscence, larger quantities of the new force will have to be brought in; thus, and thus, by degrees, the habit will tend to grow.

To put it otherwise, we may remark that it is by contrast that consciousness is stirred, not by similitude, and therefore the longer a force plays upon the system, the more will it mould that system into a likeness, however faint, of itself. By long continued action the organism, having thus taken on the semblance of the new force, will have become less susceptible of commotion upon the entry of that which is like unto itself; hence, in order to keep up the commotion which, as we have said, is pleasurable,—the commotion of which consciousness alone takes note,—the magnitude of the dose has to be increasingly augmented.

Great was Diana of the Ephesians; greater is the force of custom, and after this manner is forged, link by link, the strong chain of habit.

What now will happen upon the withdrawal of that force which habit has incorporated? It has been said that Nature abhors a vacuum, but if this be true, she has never yet given expression to her abhorrence; neither will she, for it is impossible that a negative should declare itself, since it is the *plenum* alone which makes itself felt; the *vacuum* never. To take an instance from the physical world: "the arch which never sleeps" threatens collapse, and to avert the catastrophe we buttress up the supporting piers. By these means the outward thrust of the arch is met and cancelled by the resistance supplied, and, the opposing forces equating, there is a truce. If now we remove the support of the buttresses, the plenum of thrusts and tensions previously cancelled comes into unopposed operation, and the arch yields. In like manner, if the body has grown accustomed to the stimulus of a drug, a food accessory, no matter what, the withdrawal of that stimulus will be felt, not as a vacuity, but as a plenitude of those activities which, previously nullified by the stimulus in question, now hold the field unchallenged.

One of the most serious problems which confronts the physician is the treatment of habit when this must be characterised as morbid, and when it has attained to such a degree that it can no longer be ignored.

This subject has its own experience and its own practice founded thereon, but it is too large to be

entered upon here : to two points, however, we would draw attention. In the first place, to the fact that the most inveterate habit can, in the great majority of cases, be broken suddenly without jeopardising life, and that as a rule it is best so broken. Life, therefore, does not lean so heavily upon habit as the arch upon the buttress. The sudden break will of a certainty give rise to acute distress, and so long as this lasts the sufferer must be under the most watchful, the most unremitting supervision, for he may not be responsible for his actions. Except in this way the hazard to life need rarely be considered (of course, in each case we dare not carry rule too far, but must always individualise). In the next place, we must touch on the mode of dealing with the distress which has been caused by the interruption of the habit. This may be very intense, and in order to enable the sufferer to bear it, he will need the support of a dietary as abundant and as stimulating as he can tolerate. Thus will he best meet the crisis. Then will come the need for some calmative to quiet the nerve stress. Of what nature this calmative shall be we cannot discuss, but one condition will bind it, viz., that it be so safeguarded by restrictions that the risk of curing one habit by developing another be not incurred.

Habit we recognise in other forms ; thus we

speak of a habit of thought, a habit of mind. The physiological basis of these is the well ascertained fact that the tendency to the recurrence of a mental image or of a thought process is directly proportionate to the vividness of the first impression, directly proportionate also to the number of times that the mental image or process has been revived. For the vividness of the original impression we are not responsible, but it is otherwise in respect of its revival. Practical ethics recognises that for the latter we are more or less accountable, that we have the power in greater or less degree of controlling the tendency to recurrence. Thus it lies with us to pursue a line of thought, or to cultivate an attitude of mind ; and so in the mental as in the moral world, not merely to perceive that the law of habit holds, but to recognise that in some measure its development is in our hands. This development may be to our freedom or enslavement, according as we do or do not follow the teaching of Marcus Aurelius, by "keeping from defilement the divinity that is planted in the breast, nor suffering it to be disturbed by a crowd of images, but preserving it tranquil."

The great power of custom is not less manifest in these forms of habit. This power is utilisable and should be utilised ; it belongs to the domain of psycho-therapeutics and consequently to the physician ; it belongs to education and therefore

to the teacher. The knowledge of the mode of working of this power will enable both teacher and physician to implant the habit that is sound, to eradicate that which is unsound, and by a good husbandry to develop a soil favourable to the one, hostile to the other. With this we reach limits which we must not overstep.

CHAPTER XI

THE ORDER OF TREATMENT

"Il piè fermo" (DANTE, Canto 1, line 30).

LABORIOUSLY the infant attains to his feet, laboriously through the years of childhood and of youth, in the playing-field and on the hillside, these feet acquire familiarity with the ground, but not till manhood do they take full possession. The secure foothold, the elastic step, measure the degree of this possession, and they stand as the surest index of physical health: for in the balance, static and dynamic, of which they give proof, we see the evidence of well-trained muscles and nerves, of a stable and highly organised central nervous system, higher and lower, of a vigorous and sustained circulation, an efficient digestion, and a well-ordered metabolism, without which all would fail. One might select any lesser function and say of its performance that all this to the last detail was required; this indeed would be true, since the health of the

part implies the health of the whole, but physically no better illustration of the co-operation of all parts could be given than this of the well-balanced firm tread. To stumble, in ancient times, was of evil omen, for the proudest achievement of man, the upright posture, was imperilled : and fear, when it took possession of the heart, expressed itself in a loosening of the knees,—“and of the Greeks the knees were loosened with dismay.”

Other psychic states show themselves not less clearly in gait and posture, for whilst fear lags in its approaches, and distrust halts, courage advances boldly with a clean step, and confidence awaits stout-heartedly.

Thus, in health, but in sickness it is otherwise ; now no longer is the real man in evidence, for however dauntless the courage, the firmest step must give way to the assaults of disease, the first effects of which are to take the child off his feet, and to deprive the man of that spring and elasticity which till then had characterised all his movements.

In a somewhat obscure passage Dante speaks of “the firm foot” ; the obscurity we may leave, the term we would hold, since it expresses in fewest words that of which we all are seekers, marking, as it does, the highest standard of physical health. Given health,—given the firm foot,—we may hope to go far. True, there are many things we cannot be,—“*Roi ne puis, Duc ne suis, ni Comte aussi,*

mais Grand Seigneur de Coucy,"—but if health be given and the heart be in the right place, each in his own way may be Grand Seigneur de Coucy. Life, however regarded, is, in all its spheres of activity, militant; if it is to be triumphant it demands a martial bearing.

This then is the goal, "the firm step"; how shall it be compassed? By many ways which we may not stop to consider, since it would take us away from that which we have in view,—namely, the order of treatment. Accordingly, that which now concerns us is the *attitude* in which disease, in each case, should be faced: shall the patient stand, or sit, or lie? this is the first question which we must ask ourselves.

As a general rule it is good counsel that things be not taken "lying down"; of things spiritual this is, perhaps, always true, but of things corporeal, it does not hold: in sickness, more often than not, the storm passes safest over the prostrate figure. Each case, however, must be judged upon its merits, for there are forms of disorder in which the bed is to be shunned. Broadly the test question will be this, do we or do we not wish to economise the vital forces?

In the healthy adult the efforts requisite to maintain the erect posture are deep down below the surface of consciousness. As health declines, these efforts in their subjectivity tend to rise into recognition, and in the end this cognisance may

become painful in its intensity. But conscious or unconscious, the expenditure of force demanded will be unaffected; the forces which maintain the body upright have a fixed mechanical equivalent, and this equivalent it is of which we must ask,—can the body afford it? Here lies the only reliable criterion.

Physiologists tell us that mere position, apart from the efforts required for its maintenance, has an influence upon the pulse rate,—this being quickest in the upright, least frequent in the recumbent posture. This pulse acceleration may be no true measure of effort for the whole body, but may speak for the physics of the circulation alone,—its mechanical advantage or disadvantage in the respective positions. Be this as it may, it is from the point of view of force expenditure alone that we can approach the subject, for if position as such tells, it will only add an *a fortiori* value to the argument. We come back, therefore, to the question, has the patient strength sufficient and to spare?

Every form of acute disease threatening exhaustion, demands the bed for a longer or shorter period; nevertheless we must not forget that, apart from the economy involved, the recumbent posture is not an unmitigated blessing, but brings with it disadvantages, both general and local. Thus it means stagnation of the system generally, and of the part, and both may seriously endanger life.

The sluggish metabolism of the whole body involved by confinement to bed is obviously detrimental, and to make clear the serious bearing of stagnation upon the local disorder we need only instance the risk of a hypostatic congestion of the lungs. These contra-indications must be carefully weighed against the indications for rest before a decision is arrived at. Fortunately in many cases we are able to meet these disadvantages of posture by devices of one kind or another, and of late years the development of massage, and of the system of movements active and passive, has allowed us much more safely to apply the general principle of rest, since by these means we can in a sense take exercise for the patient, and present him with the fruits of a labour not his own.

At whatever stage of the illness,—at the onset, during the period of maximal stress, in the decline, and throughout convalescence,—this question of posture and of movements as the means of apportioning the rest and exercise which we deem advisable, will require primary consideration and a nice judgment.

Next in the order of treatment must be weighed the question of the *nurse* in the twofold aspect which she presents ; in the first place, as an instrument of rest, as a means, that is, of applying this principle more completely by the skill with

which she economises the forces of the patient ; in the next place as the companion and expert, who by her presence conveys to the patient that sense of security, the comfort and value of which it is at times difficult to over-estimate. This second aspect of the nurse is essentially psychic, but inas-much as repose of mind may be as essential to the recovery of the patient as repose of body, it is not less important. From either point of view the nurse ministers as the instrument of rest ; and by the care which she bestows upon details she will give proof of her efficiency, and not by her cap and apron ; for as the cowl makes not the monk, so the uniform makes not the nurse.

The value of the nurse as a means of saving the bodily forces of the sick is obvious, but too often do we overlook her psychic value. We are not discussing here the question of the mental nurse as a specially trained attendant, but of the nurse in her all-round fitness to wait upon disease. The pathology of loss of confidence is obscure, but it looms large in the sufferings of the patient, and it is frequently far more baffling to the physician than the more material manifestations of disease. Panic, loss of nerve, are other names for the same phenomenon. In the hurly-burly of life, though health prevail, panic may prove of supreme moment, as history relates ; in the sick chamber it is not less vital. Unto such as suffer in this manner we must lend courage, as we would lend the strength of

our muscles to the infirm body,—to this end companionship.

These two aspects will not sum up all the points of view which the subject of the nurse presents, but they are perhaps the most important.

Having decided upon the posture of the patient, the degree of rest or of movement permissible, the need for a nurse to administer and to companion, we shall next have in mind the *surroundings* of the sick man. If confined to the room the choice of this, its seclusion yet accessibility, its aspect, airiness and warmth, in brief its hygienic qualities, these all will demand our attention. We must be content to leave details, for so long as we are clear as to what it is that we wish to secure, viz., the patient's comfort and well-being, the particulars may well wait upon the occasion. We may here with advantage remember a favourite dictum of Sir William Jenner, that the best room in the house is not too good to be a sick chamber, and we shall not forget, especially where the prospect of illness is a long one, that the smallest trifles, even to the pattern of the wall-paper, are not beneath consideration. The weakened mind is irked by small things, and owing to the facility with which it perverts and distorts, it is easily obsessed by shapes and colours, apparently of the most harmless description. It is thus that a picture or the design of a paper may get upon

the nerves of the patient and be literally an eyesore.

The atmosphere of the sick-room should be as reposeful to the mind as to the body. Deliberately, after the manner of the wounded animal, the patient has withdrawn himself, or suffered his withdrawal, from the commerce of the world. See to it that its wares do not find ready access; the sufferer is in no mood to traffick, mind and body alike resenting as irritants those very influences which in health are wont to act as exhilarants. The visitor then, if admitted, will bring with him such news only of the outside world as may be deemed acceptable, and capable of giving that assurance for which the sufferer craves. God loveth a cheerful giver: unto none is the cheerful gift more welcome than to the sick, and the nature of this cheerful gift is repose of mind.

Open wide then the door to all health-giving influences, physical, mental, moral; but make it fast against all those which would hinder the healing powers in quiet session.

Next in order of merit will come the question of *diet*, or the selection of that pabulum, out of which the organism shall extract most advantageously the forces which it needs.

Experience has determined more or less definitely an order of digestibility among foods, this furnishes us with the diet scale. Science has extended the limits of this scale by means of the digestive ferments, which enable the use of the several food-stuffs in various stages of predigestion. From this scale we have to choose, and having chosen, our next duty is to order the frequency of administration, adjusting the taking of food to the periodicity of the daily swing of vitality, its times of ebb and flow, and weighing carefully the question of the relative needs of the body for sleep and nutriment. Not lightly shall we break in upon the sound sleep.

Upon the question of diet will follow the question of the employment of the *food accessories*, and notably of alcohol. This subject should receive the judgment of an open mind and not be made the strife of party. There is no reason why the molecule C_2H_6O should be anathema, no grounds for believing that of all groupings of atoms this one alone is of the Evil One. It is there for abuse we know, but this implies that it is there for use also: *fiat experimentum*.

In the employment of alcohol we should ever bear in mind its appellation, *food accessory*, and endeavour so to time its stimulation that the forces which it unlocks may be utilised to the

better digestion and assimilation of food. In this way it will assist in the storage of force, for the balance will be in favour of the energy so introduced as compared with that which has been unlocked or dissipated by the alcohol. This will be the ideal use of alcohol, viz. : as a food adjunct attending upon assimilation. Itself we have seen to be a food, but, as already explained, it is never employed as such : upon its qualities as a stimulant must we concentrate attention.

Such is the ideal use of alcohol, yet upon occasion we may have to rely mainly, if not exclusively, upon its stimulant powers, independently of their utilisation for the introduction of food energy. Such occasion will be of the nature of a crisis ; such use will be temporary only. The theory here, as we have previously explained, implies the utilisation of reserve forces which for one reason or another the body itself cannot unlock. Upon an occasion of this kind, exhaustion may threaten in the midst of plenty, the patient dying simply because his stores of energy are not available.

Acute disease may call for this use of alcohol, chronic disease never ; since we can be justified in spending thus without stint, then only, when we can look forward to a natural termination of the disorder, to reach which goal we are encouraged to strain every nerve.

The other food accessories of the stimulant class

which belong here, are comparatively insignificant. They serve as minor adjuncts to digestion and assimilation, and they strike a correspondingly minor note in the physiology of diet.

Not till we have arrived at this stage may we proceed to consider the use of the *materia medica*. On this subject what more is there to be said? We shall apply the medicaments in quality, in quantity, and in time, as experience has taught us their efficacy and their opportunity. We shall use them in the full conviction, as George Herbert expressed it, that "herbs gladly cure our flesh because that they find their acquaintance there,"—recognising in the virtues of herbs and minerals qualities akin to the properties which are manifested by the animal tissues, and therefore adaptable to their needs.

How indeed should it be otherwise, except we fail to see unity in the scheme of creation. But if unity, if of the same family, why not co-operation; are not all things adjusted to this very end, even as the rows of the upper and lower teeth, as Marcus Aurelius has it? Resemblance qualifies for assistance; if things are like in that which they possess, they are able *pro tanto* to act as adjuvants, whilst contrariwise, reinforcement is not possible on lines of dissimilarity. Dissimilarity necessitates unfitness, unfitness means

discord, and discord would argue two creative principles at work in the universe out of harmony the one with the other,—the house divided against itself which does not stand. But the house of Nature has stood, and therefore must we see in the elements of the *materia medica*, elements in harmony with their surroundings, and as such to be made use of. Here is the groundwork of a treatment based upon a noble *ὁμοιοπάθεια*, primordial, incontrovertible.

At this stage accordingly we shall consider the *how*, *when*, and *where* of medicinal application, and with a clear conscience shall write the prescription. We shall not forget in so doing that in the vast majority of cases it is for temporary use; to be withdrawn at the earliest opportunity, mindful that the tendency is for the organism to lean upon the medicament and to make for its incorporation. Thus upon our guard, we shall best avoid the building up of habit.

Sometimes, but in the rare exception only, the prescription may have to be lent permanently, because from the nature of things the organism has acquired a morbid bias from which it cannot recover, as for instance, in the disease *myxœdema*. Even here we shall strive to reduce to its minimum the extent of the loan, so that we may perhaps include these very exceptions in the rule that the prescription is *lent to be withdrawn*.

In those instances of disease whose happy termination is recovery, we recognise a final stage, that of *convalescence*, which must be considered separately. Before that stage has been reached, we shall have begun to withdraw one by one all those auxilia, by means of which the patient has been able to give battle successfully. No sharp dividing line obtains anywhere in the progress of disease ; it is true that in certain cases and at certain stages the morbid movement may be quick even to abruptness, witness the crisis in a typical example of pneumonia, but here, though the gradient be steep, the line is unbroken. Insensibly then we shall pass from sickness into convalescence, and the withdrawal of the aids begun with the abatement of the disorder, will be continued *pari passu* into the relatively quiet waters of convalescence. Treatment ideally should follow the curve of disease, bending its own line to a corresponding sinuosity, now rising sharply, now maintaining a level, now falling slowly or quickly in obedience to the pathological call.

Assuming that the therapeutic attempt has been so to adapt itself, we find ourselves now in that after stage, in which the bed, having done all that it can, has given way to the couch, this to the easy chair, and this again to the great adventure of the feet, steadied in their first endeavours by the friendly arm. At this point the question which presents itself and begins to press, is the question

of *change*. What do we understand by this word, —what precisely does it convey to the mind?

First we understand it as an exchange of hygienic conditions,—necessarily restricted by confinement to bed and room, which the acuter stages of the illness exacted,—for conditions less fettered. Foremost among these enlarged conditions is an out-of-door life, whose ventilation from horizon line to horizon line regards alone the points of the compass. Such life secures in its purest form the air we breathe, and into which we exhale at every surface pore. In its inner significance it means primarily the positive value of a vital medium at its highest energising pitch, as exemplified by its oxygen, ozone, or other holding. Secondly it means the negative value of the same medium in its highest state of purity, *i.e.*, as an air not only quick,—vital,—but unpolluted : in this second quality it exemplifies cleanliness, or asepticity.

Next the out-of-door life means the power of the sun at its highest actinic value, its rays relatively unrefracted, unreflected, unfiltered, unpolarised,—direct.

So much is meant by the liberty of the air and of the sun : so much, and much more ; for in that our surroundings minister to the body by way of the five senses, so, by a change of venue, the influences which stream in along these paths will be changed. The out-of-door life, be it in the open fields, or on the high seas, or on the edge of the waters, brings

a very quincunx of powers to bear, to borrow an expression from the author of the "Garden of Cyrus." Thus the tingle of a keener air, the action of a more vivid sunlight, speak to the surface of the body, and as we inhale the more vital medium, impregnated with the scent of tree and flower, of seaweed or sea spray, we both smell and taste. The eye is spoken to in a thousand ways by diversities of light and shade, of colour and of form, and the ear responds to countless auditory influences, from the noise of the great waters or of the wind in the trees, to that rarest, most attenuated of symphonies, in which the ear delights, the stillness of night in solitary places. None who have experienced can doubt the recuperative power of these influences, the action of which is again of a twofold character, first positive, in their direct play upon the body; then negative, in the release which they give to parts jaded and blunted by the long-continued, unbroken action of unchanged surroundings,—such, for instance, as befall the workers in crowded cities. In this second aspect, change is but an application of that many-sided principle, rest.

After such manner does change operate, and if it is not always effective, at least it offers the best opportunity for recovery.

And when in this way the round of treatment has been completed, and the clearness of eye has come back, with the strong grasp of the hand and

the firm tread, we may bid the traveller God-speed, and let him go on his way rejoicing. But if the part of the good Samaritan shall have been played in vain, food and raiment having been given and the healing salve applied, and the lodging and the penny bestowed, and all to no purpose ; if, in spite of all that surroundings can do for the sick in mind and body, still the cure delays, is there anything remaining over and above wherewith he may be benefited? The answer to this question must be in the affirmative, for there still remains one thing to complete the office of the ministration to the sick : the word of good cheer, not purchasable by pennies, not to be weighed in the scales, yet upon occasion the one thing needful, the one thing lacking, capable, and by itself alone, of transforming the meanest clothing into the wedding garment, the repast into the feast, the bare lodging into the house beautiful. We may be sure that this ample word was not wanting to him that fell among thieves.

CHAPTER XII

IMPONDERABILIA

"Non pane solo vivet homo."

IT was customary, in the older treatises on physics, to class under the heading of the *imponderables* the forces of light, heat and electricity; when, however, the step had been made from the indestructibility of matter to the conservation of energy, and thence to its corollary, the correlation of the forces, it was no longer possible to justify this classification. Each form of energy could now, in theory at least, be converted into its congener; each had its mechanical equivalent, was in fact but a mode of motion, and could be stated in terms of momentum; each, essentially bound up with matter, was a material manifestation, in nature one with those other material manifestations of which the force of gravity was but an instance. Here was nothing supersensual; here, no way to escape from the mastery of that world which we possess, and

which possesses us, within the limits of the five senses.

In the grasp of the warm hand the lump of ice melts and slips through the fingers. We catch the drops of water in a vessel that none may escape, and into the mobile particles continue to pour heat ; under our eyes the liquid disappears in a commotion. We close the space within which the liquid has vaporised, but without putting restriction upon the freedom of movement of the confining walls, and still we pour in heat : without cease the confined space enlarges, adapting itself to a more and more attenuated medium within. Without end is the process of rarefaction and expansion by which the matter is enabled to compass the inflowing force ; nor can we conceive of limits to the capacity of the vapour. Reverse the order of events, and upon the removal of the heat the particles draw together until a denser vapour becomes a liquid, the liquid a solid, and the solid continues to shrink more and more. Now contracting, now expanding, it is thus that matter suits itself to the quantity of energy presented, nor can any fulness of stream outflow its limits, nor any dearth leave it void.

We are apt to trouble ourselves about what may happen at that further limit of emptiness, the absolute zero, at which point a perfect gas should occupy no volume at all. It is a vain thought—in a force-containing universe matter can never be wholly drained of energy ; we may heap up the force

here, exhaust it there, wholly withdraw it never. By means of the Sprengel air-pump the most perfect of vacuums is obtainable, but the vacuity reached is only of the nature of an infinite approach, completion is not possible; so the withdrawal of force will approach, but can never attain to, a complete exhaust. Matter and force thus infinitely associated are unthinkable the one without the other,—combined they constitute an imperishable ponderable.

So marvellous is this linked existence of force and matter in its unity of nature, its infinity of manifestation, and its inviolability of being, that it is no wonder that the mind, absorbed in its contemplation, has only too frequently been unable to see anything beyond. Matter and force in their endless shapings and quickenings have filled the universe: unto each variation in form, a corresponding variation in activity. In a universe such as this, filled to the brim with force cohesive, adhesive; force caloric, actinic, magnetic, electric; force chemic; force biologic—what room should there be for aught beside? Everything, then, is to be ponderable, everything indestructible, every sequence inevitable; the whole reduced to a worship of the brazen sandals of Empedocles.

The word imponderable, then, must it go with all its significance? Assuredly not: that were a great calamity; for if great are those things which the senses seize and hold securely, greater yet are

those which they apprehend but faintly ; if full of beauty the things of sight, of richer promise far is that darkly obscure in which imaginings take misty shape. If firmly we believe in things visible, more firmly still must we take hold of and possess things invisible ; no lesser creed shall satisfy the soul,—*imponderables* there are.

But physically, physiologically, therapeutically, of what moment is this satisfaction of the soul? Emotions, aspirations, beliefs, those subjective accompaniments of the physical life which constitute the spiritual life and give this very satisfaction : what may their true value be in terms of the real, the tangible? Where do they take rank in the correlation of forces ; what is their mechanical equivalent? Will they deflect a leaf from its appointed course as it flutters to the ground : can they divert even by a hair's breadth the unswerving course of material interactions which follow each other so inexorably? If not, are they aught but a meaningless by-play? And music, and art, and poetry, those wings, as we have been wont to regard them, by whose aid we seem to touch, brush, skim, the surface of an evasive absolute, are they wings of wax to melt at the glance of an indestructible matter, and an energy which it conserves? And the "I believe," can you weigh it? Is not this the realm of the mystic, the phantastic, and does it really signify, O man of common sense?

This subject calls for the earnest and sober consideration of the physician; to pass it by is not possible, for unmistakeable is the witness which history bears upon this point. Read the records and say if to its very foundations the earth has not been shaken by the "I believe"; if it has not groaned beneath the burden of this imponderable: groaned in anticipation and in realisation of the warring of nations with nations; if every material power of nature has not been coerced into obedience to its confession of faith, and whether in these two words there have not lain hid the momentum of powers, principalities, and dominions, the dynamics of a universe? And in the face of evidence such as this, that the cosmos has been moulded like the potter's clay by the *credo*, shall the physician treat with indifference its physiological value to the individual?

Even so we shall not escape the comment, but all this is speculative, transcendental, not to say visionary: it behoves us to look at things in the clear light of day, dreams must not possess us too much, the imagination must be curbed; we must be level-headed in this work-a-day world. It is quite true, we must; and to this end we shall first ask, Who is this level-headed man to whom we are called upon to make obeisance, and what is his exact value as compared with the value of the man who sees visions and dreams dreams? The answer to this question demands a test of personality, and

fortunately this test is easily determined ; for we shall surely agree that he who influences, who moves most his fellow-men, that he is the most powerful personality. But to move one's fellow-man one must move his material surroundings with him, and therefore to make the test as matter of fact as possible, let the physicist give judgment. He will tell you that a force is to be measured by the momentum which it generates in the unit of time. Convert now into its mechanical equivalent the actual physical commotion caused by the activity of man, and let the unit of time be the span of his life,—then say which has been the greater force in the world's history, a Peter the Hermit, a Francis of Assisi, an Ignatius Loyola, or a—well, a level-headed man. The shock of contending armies, the impetus of fleets, the upheaval of a hemisphere, let these give the answer.

Nor does this test apply only to the world in its more serious moods, for, to be in lighter vein, but still to be gauged by this same test—the power to move—would we not willingly exchange all the mother-wit of a Sancho Panza for but a modicum of the sublime folly of a Don Quixote?

In other ways less vibrant the same truth is borne in upon us, and to curious reflexions does it give rise. A Michael Angelo fashions a Pietà out of the marble, and, assuming that he does himself the mechanical part of the fashioning, he spends upon the marble a given quantity of actual mechanical

force. Now, it is conceivable that the same amount of mechanical energy should be spent upon the same subject by another sculptor, working upon a similar block of marble, but with what different result! The one group shall leave you cold, indifferent, untouched; the other shall stir you to the depths. Of the one the magnetism will be such that you shall be drawn to it from all parts of the globe. The stream of life shall set towards it and the colossal mechanism of travel be put in motion by this living force; whilst the other, devoid of any power to attract, is practically non-existent; yet, *ex hypothesi*, the same amount of physical energy has been spent upon the one and the other.

To make the cases more parallel, we may suppose the one work a copy of the other, but a copy which just misses the master touch, in all other respects identical,—of the same marble, of the same dimensions; identical also, as we have premised, in the amount of mechanical energy expended upon each. What laws of physics shall explain the difference which will here be found to exist between the response of the environment to each? We know that if, in the language of the physicist, we do work upon matter, we bestow upon it a potential which is in exact proportion to the energy expended. So many foot-pounds used in raising a given weight to a given level, so many foot-pounds will it possess so long as it keeps at that level, and as many foot-pounds it will give back in the act of returning to

its former level, whether you choose to utilise or to waste these. But in the case of these sculptured stones the energy bestowed upon each has been the very same, and yet they carry and convey potencies so immeasurably different.

We have here before us the mystery of form in its relation, or want of relation, to the energy which has begotten it. The same quantity of matter wrought upon by the skilled hand may receive and absorb in the fashioning far less energy than from the unskilled hand, yet the one form is as full of specific power as the other is empty. The two forms differ in line, but the line which has been shaped at less physical cost is instinct with life, whilst the other is dead to its surroundings. Like a ferment, the one becomes the centre of a perturbation which the other is powerless to excite.

An added mystery which removes the work of art more completely still from the category of things physical, is to be found in the absence of any recognisable loss on its part in the act of giving out its powers. We come to the picture or the statue, and we take from it an impulse which changes the whole course of our lives ; a kindred something has been touched, dormant activities are awakened, we recognise a call, a vocation ; the determination of life is changed, its energies are multiplied and focussed ; we begin to live :—the life-giving picture and statue are unimpoverished. Another and another in unending series will come and get the

inspiration which he needed ; the emanation, whatever it is, will not hasten the fading of the colours in the picture, or impair the lines of the image, and, so long as these last, the well-spring of power shall not fail. What is this emanation, whence came it, how can it be given and yet not spent, how reconcile its nature with the nature of things physical, and the iron law of give and take ?

We speak of a dead past, but in the presence of this record what do we mean ? No, so long as the mystery of form and its energising power shall persist, so long shall the world be in mortmain, and the product of the dead hand a living thing in our midst.

And what is true of art as it affects the things of sight, is equally true of art as it affects the other senses. What proportion, man of science, is there between the effects of a given volume of sound, in disorder, so to speak, and in that form of orderly arrangement which we name music ? Sum up as energy pure and simple the constituent wavelengths of a sonata of Beethoven, and equate this with the sound energy of some barbaric performance which to us may differ little from mere noise. What physical relation is there here between cause and effect, as measured by the sense of hearing, and what relation between this and the original output of energy by means of which Beethoven transmitted his genius to paper—the wonder of it is all there in the score or its transcript.

Again, in the art of speaking and of writing, the same truth holds. Unto this one propound a thought, and toss him a dictionary to cloth it with. What an immeasurable difference, according as he has or has not at command that "*proprietas splendorque verborum*," of which the younger Pliny wrote, with the art to fit his style to his matter! Duly apparelled, the thought shall be a spark to kindle, a seed to germinate ; unsuitably clad, its garment shall be a cloak to cover and conceal. Yet in the one case as in the other the mere physical energy spent upon the uttered word or the written character may have been the same. No proportion physically, none whatever, is there between the mechanical energy spent upon the figure of speech and its moving power.

The reproduction by mechanical means of the picture by the camera, of the sculpture by the cast, of the music-score and of the written word by the printing machine, does but add to the marvel of it. At the outlay of a calculable quantity of mechanical energy, the artisan now becomes the painter, sculptor, musician, poet, as the case may be ; or is it that the dead hand, alive in its own creations, still works upon the sensitive plate which the chemist prepares ; moulds the gypsum which is brought in fluid readiness ; guides the fingers of the type-setter ? In any case we come back to the disproportion, multiplied now indefinitely, between the physical act which works upon the vacant

canvas, the shapeless block, the blank sheet of paper, and the immeasurable forces of which these become the carriers.

There is a saying among sculptors that clay is life ; plaster, death ; marble, resurrection : in these words is conveyed the different effect of the same form presented in these various materials. Assuming that form is accurately reproduced in these several presentments, we can attribute the differences in effect to surface action alone, and without doubt herein is the explanation needed ; the incident light being variously modified by the different surfaces before it reaches the eye of the beholder. Slight as may appear these material differences when compared with their effect, there is no mystery here ; but when, as in the instances given, the materials are identical, then it is the changing line alone which brings about change of effect ; and in this shaping, as we have seen, there is no quantitative relation to physical effort : here is the strange thing.

Still after all it is to matter that the imponderabilia lend themselves ; in what guise we ignore,—an impenetrable cap of darkness yet hides this from us, but the relationship is clearly less close than that which obtains in ordinary physical manifestations. Some of the fetters which bind force to matter have been cast off, for whilst all the qualities of matter may be impressed into the service of the imponderables, these powers them-

selves defy those measured limitations which the physical forces own.

But if we are compelled to admit that the connection between potency and matter is not fixed, indissoluble, the way is opened for possibilities of union of all degrees of closeness ; of severance of all degrees of completeness, and it will no longer be ours to deny that some agencies may exist whose workings may, in a degree at present unimaginable, be unfettered by the chains of ponderable servitude. We shall then perhaps cease to claim to measure the Divine breath in calories, and to impose conditions upon the influences to which man is subject.

We need not fear that by admissions such as these we shall be abrogating Law—Lawlessness is an inconceivable. Each grade of agency, if we may imagine the agencies in scale, will be obedient to its own code ; which code will be inexorable. Nor need we fear that one code will antagonise or be in contradiction to another : such antagonism would again be an inconceivable. All that we shall be justified in concluding will be that the barriers which we have ourselves erected straiten too narrowly, and must be cast down to make room for life in its totality.

A further consideration remains :—we have spoken of the power of form and of its independence of the mechanical effort which has developed it ; another kind of independence of the ponderable must now be noted. Under given conditions of

temperature and pressure we allow that the capacity of a given space for matter is limited and fixed—not so the capacity for form. A sphere of one inch in diameter is infinitely capacious so far as form is concerned; there is no limit to its plastic potentiality, and, stranger still, this capacity is independent of the size of the sphere. This becomes evident when we observe that the smallest spherule has the same angular capacity, of 360 degrees, as the round world itself. The reproduction of form may be in small or in large, but form, *per se*, has nothing to do with dimensions but solely with proportions, and these proportions can find room within the minutest globule as readily as within the Infinite itself.

Within these two infinitudes of the Great and of the Little which Pascal has described for us, what scope for the artist! From this point of view let us also observe that the infinitely Little takes equal rank with the infinitely Great. Imponderabilia—mirabilia!

But what is the bearing of all this upon the laws of therapeutics? None at all, unless we recognise that life is touched by things imponderable, as well as by things ponderable. When Brennus the Gaul cast his sword into the scales he threw in so much weight of metal: this it was easy enough to match in gold; but of that imponderable which the act symbolised, who shall attempt to calculate the mass,

or the effect of a "Væ Victis" upon a Roman people then, and the world now ;—the treasure-houses of the peoples have not gold enough to set against the brute-weight of words such as these. Leaving war for peace and its arts, it is certain that, unless we recognise in shape, in colour, in composition, in accent, forces whose potencies we are prepared to allow though we do not pretend to measure them ; unless, in a word, we make room for the imponderables, we shall indeed miss the mark.

The problem of life with which we have to cope requires for its understanding a full and fuller recognition of the laws of physics and of chemistry ; these, however, will carry us but a part of the way of understanding. Who has not seen the life of the body, in all its departments, languish for lack of an ideal, for want of an object upon which to fix the mind or heart ? To meet this state of things it will not profit to order a change of diet, a regulated scheme of repose and exercise, a modification of the clothing. Then too will hygiene fail us, as also will medicine, though we turn to the *Materia Medica* and invoke its aid. In despair we shall perhaps counsel travel ; in vain,—we may change the sky, we shall not change the spirit. The rules of bodily health, the virtues of herbs, the stimulus of altered surroundings, will alike prove ineffectual ; the thing which is lacking is an interest, not a rule of health ; a desire, not a drug ; a purpose, not a distraction ; and it is in default of these that the faculties lie

dormant and the tide of life runs low. Here is latent a poet, an artist, a man of science, a philanthropist, and till he come in this or that guise, and with him the more abundant life of the spirit, the more abundant life of the body will tarry also, for inseparably intermingled are the grosser and the subtler essences. The touch which shall give life, when it does come, will come not by way of the laws of matter and of motion, but by way of the laws of the spirit, so true is it that "man shall not live by bread alone."

Not all artists paint, neither are all painters artists ; a master of the brush has said this, and the saying holds in all departments of life. Not all physicians practise, nor are all who practise physicians. Again and again one sees the layman possessed of the truer insight into the needs of the body, to the confusion of the certified possessor of technique. To realise the importance of the foregoing, it is not necessary to wear the cap and gown ; it will be patent to all, and it is our common concern that it should be manifest, seeing that it concerns our common weal. Each one of us, initiated and uninitiated, may upon occasion be called upon to play the physician and observe and infer ; each may have to perform the timely act, or speak the word in season which shall have power. Upon each therefore responsibility will lie, but it will lie heaviest upon him who, having the knowledge of the intimate relations between mind

and body, fails to utilise this knowledge, and rummages on his shelves among the ponderables for a potency which is not there.

But it is not by default alone that we take cognisance of the ailing mind and body. In the absence of the things of the spirit we shall miss the uplift which they alone can impart, but in their presence we shall not always be supported. From the box of Pandora, the all-gifted, there escaped many ills, but none have proved more burdensome than those darker spiritual influences which the Gods also bestowed. The word "imponderabilia" as applied to them does indeed seem a misnomer, so heavily may they weigh down and abase. In the lives of the Saints nothing is more striking than the periods of exaltation and of humiliation through which they passed, and which marked their spiritual progress. If they, like no others, have scaled the heights of beatitude, like none other have they sounded the depths of anguish and called *de profundis*. And "Brother Body" has felt the impulse of these things which no material balance, however delicately poised, can weigh, which no laws of matter or of motion with which we are acquainted can limit,—and it has moved in obedience to their touch.

To pursue this subject, even if qualified for the task, would lead too far. The pathways along which the burdened spirit travails or the darkened mind goes astray, these belong to the domain of

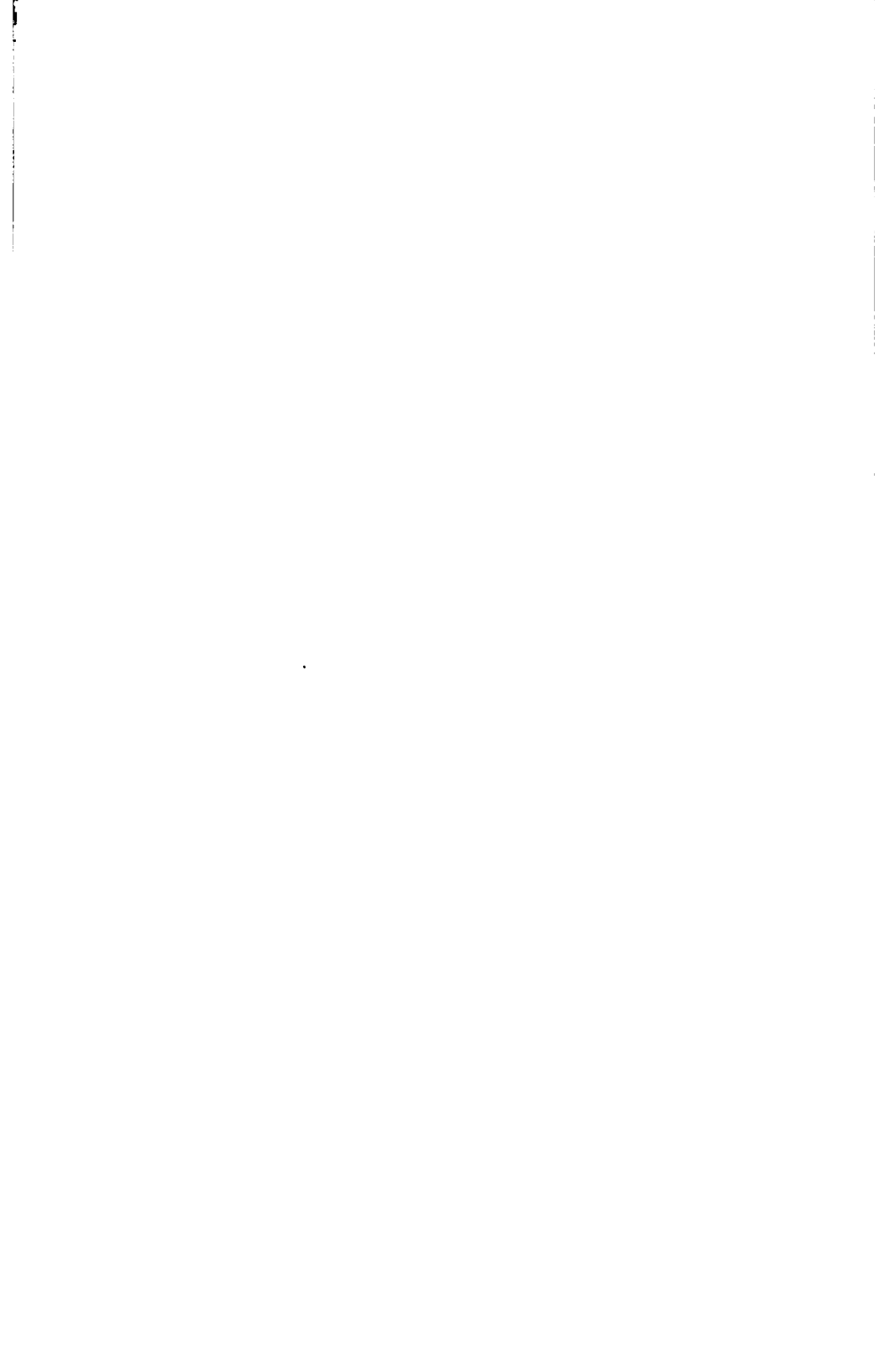
psychology in the widest acceptance of the word, and this chapter does but hint at some of the problems which lie by the way, and point in the direction in which we must seek the means for their solution. Prominent among these problems will be the legitimate sphere of usefulness of suggestion as a therapeutic agent—legitimate because we may not forget that the make-believe confronts us under a two-fold guise, namely, as the *suggestio veri et falsi*. We shall not quarrel with its application in the former shape, but the use of the latter, even with an honest motive, will require careful and particular determination in each individual case. If, as we have said, we lay most store by the things of the spirit, we shall scarcely be able to justify a wound to the moral sense by the cure of a bodily hurt ; neither shall we care to build up a physical stability at the cost of a psychic instability, seeing that strength of character is of more worth than strength of body. The test question to be asked in each case will therefore be : How is the remedy likely to benefit the personality as a whole ; what will its influence be on the mind, body, and spiritual estate ?

Time was, the physician of the soul was wont to take in hand the affairs of the body also, somewhat disastrously it must be confessed to the material welfare of the latter. He has been dispossessed and his own domain invaded by the psychologist, whose special field of investigation includes the

inter-relations of mind and body. But are we not inclined to be too material in our conceptions, is there not room for us all ; indeed will not any room which excludes the one or the other be too small to contain man, his capabilities and his needs?

And after all if we must pick and choose from among the gifts of God, where all are good, will it not be the things of the spirit by which we shall lay most store?

EPILOGUE



EPILOGUE

THE THERAPEUTIC OBLIGATION

*"Contra vim mortis
Non est medicamen in hortis."*

THE skilled swordsman will allow that even the tyro at fencing may get in an occasional home-thrust if he do but attack with sufficient boldness and agility; the veteran may add that, in a sense, the chances of scoring a hit will be greater, the more reckless the play of his inexperienced antagonist and the less his regard for the strict rules of the art, inasmuch as it is the sudden, the unexpected, the irregular which may baffle and outwit the science of the schools: on the other hand all will recognise that for the beginner to act upon the defensive alone, is to court certain and speedy disaster. But he whose business it is to play at the game of quarte and tierce with Death, knows only too well that, however skilled he himself may be, his only chance is to mend his defence,—for him the attack is forbidden. In no

line is his stern adversary vulnerable, and to put off the evil day when his opponent will no longer be denied, that is his only endeavour. When that time shall have come, no healing herb in all the gardens will avail anything.

In the foregoing chapters it has been our task to consider those general principles upon which the *Materia Medica* may be called in with most advantage to assist the body corporate. To what end? This question might well claim precedence of all others, certainly of all others relating to mere ways and means. It should be the first to confront us, and its postponement until now is justifiable only upon the grounds that the consideration at this late stage will not invalidate its claims to precedence, which are indisputable; whilst for other reasons it comes appropriately as a last word, summing up in brief the objective before us, concentrating attention upon that point to which our labours should all converge. To what end then this formidable array of remedies? To what end these general principles of application? To the relief of pain or of disease, generally, in the literal meaning of the word; to the greater efficiency of the body as a whole; to the prolongation of life. Singly or jointly these aims will call for our utmost endeavours until that time, which will come, which must come, when the *cui bono* can receive no satisfactory answer, the expectation of life being too short and there being no reasonable hope of prolonging it to future use-

fulness. Even then if we are able to relieve distress there is still room for us, but if this may not be, if, on the contrary, our efforts to eke out existence do but lengthen a hopeless struggle, fretting instead of bringing comfort, then it will be for us to remember that the obligation to protract life at any cost is not laid upon us. In this view of our duty we shall be strengthened if we bear in mind that the sting of Death is in the foretaste, in the anticipation, rather than in the realisation. However grim-visaged he may appear in the approaches, even unto the forecourts, in the Presence Chamber he is wont to unmask and reveal the face of a friend. Forbidding enough "his images and storied aspects,"¹ whilst we contend with him for the mastery, but his victory assured and accepted there follows peace, and for the wounds which he has himself inflicted, it is his custom to administer an unfailing opiate,—in a drowsiness we take our departure.

It is said that Hippocrates forbade the administration of remedies to those that were past all hope, "*desperatis vetat Hippocrates adhiberi medicinam.*" This injunction we may heed as a counsel not to make difficult the last stages, so we recognise their finality. None can relieve us of the responsibility of judging when this moment shall have come : we

¹ "*Les Simulachres et Historiees Faces de la Mort,*" commonly called "*the Dance of Death*"; Holbein Soc., facsimile reprint.

should bring to the bedside a great hopefulness, a determined optimism, but if, thus armed, the futility of the strife is irresistibly borne in upon us, then we should put aside our remedia as cures, and ranging ourselves upon the side of Death, make easy the couch with such solatia as may offer. He would come as a friend, let us not compel him to hostility, since he must prevail.

But if this counsel be a hard one to follow even then, when by lapse of years the body is at its far limit, or by protracted sickness the vital powers are exhausted, how much harder when in the plenitude of life Death presents his claim. Without the due punctilio of war, without sound of parley, without the compelling entrenchment, mine or sap; on a sudden the summons to surrender comes,—Death is at the gates and incontinently threatens assault. Only too frequently do we witness this tragedy; symptoms may have occurred, but they have been of so slight a nature as to be set aside as insignificant, and the physician is consulted by the way, so to speak, and with an apology almost for bringing so trifling a matter before his notice,—then it is that the real gravity of the situation is revealed. Here is found a tumour, as to the malignancy of which there can be little doubt,—without warning it has taken possession of the tissues, and we stand face to face with the weightiest of responsibilities. Shall we have recourse to the surgeon, upon whose skill we can rely, and if operable advise operation;

or shall we, contenting ourselves with the employment of palliatives, fold our hands and watch inevitable developments? Can we hesitate, is not anything better than the latter course, is not any risk to be preferred to the passive acceptance of defeat, and the hopelessness which inaction begets in the patient and the surrounding circle of friends and relations? More than ever does the physician stand in need of a wise circumspection and sober judgment in order to meet the not unnatural impatience which inactivity arouses in the minds of all concerned. Very deliberately must he debate the question, and consider whether this growth is but a captured outwork of the body, or Death be really in possession within the walls, and the tumour only a local demonstration in force. Everything will depend upon the answer to this question; for whilst it is clear that any risk seems preferable to a foregone conclusion, yet if operation does not hold out a reasonable hope that, with the risk which it brings, it does convey a chance, even remote, of cure or decided relief, what can be said in its favour? If in reason it can lead us to expect a prolongation of life, in reason it can be advocated; but if the balance of probability is on the other side, with the likelihood that the course of the disease will be precipitated, it must be unhesitatingly rejected. At the first glance nothing seems more to be condemned than the idle hand, but it is deserving of praise if its activity can only work

folly : above all we would shun a busy foolishness.

This will not mean a denial of all hope, too little are we acquainted with the powers of the body to be able to dogmatise thus absolutely upon the chances of life. We must recall the example of Paracelsus and his unconquerable hopefulness, and leave open those more recondite paths which to our amazement nature sometimes enters upon, and which lead from the very threshold of death back to life. It may not be our duty to point to ways so rarely trodden ; this might raise hopes beyond their justification, but we dare not close them : “ Nie rede der Arzt, die Krankheit ist unheilbar.”

It comes then to this, we are asked to give guidance, and standing outside the inner circle where hopes and fears conflict and confuse, to judge dispassionately upon reasonable probabilities. We may not shirk the answer which is sought of us, and which we must frame upon the teachings of experience and the facts of the individual problem before us. Upon the data which we supply, decision must be taken :—by whom ? Primarily by the patient, if we judge that he or she is capable of bringing a sound mind to bear upon these data, and we have no reason to believe that there is the wish to shirk this responsibility. Secondarily, by the relatives and friends, and preferably by these in council with the patient. We may persuade, we may urge this or that course, according to the

strength of the conviction that is within us,—this in a sense is optional: the one thing that is obligatory is that we bring before the patient and his circle all the facts which we deem to have an essential bearing upon the case. Finally, should the decision be left to us, as in many, perhaps in most, cases it will be, and we conclude that all things considered, it is wiser to stay the hand than to be active with it, then we must have the courage to let it be idle, and to abide the issue.

We shall be confirmed in this course and consoled, if, with the words of St. Paul sounding in our ears, "Behold I shew you a mystery," we are able to see only so far as the Latin poet saw when he wrote: "Non omnis moriar, multaque pars mei vitabit libitinam."

"Multaque pars mei,"—and that large part—the greater part, the better part.

"PORT AFTER STORMY SEAS,
EASE AFTER WAR,
DEATH AFTER LIFE,
DOTH GREATLY PLEASE."

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